PULP & PAPER

November 1982

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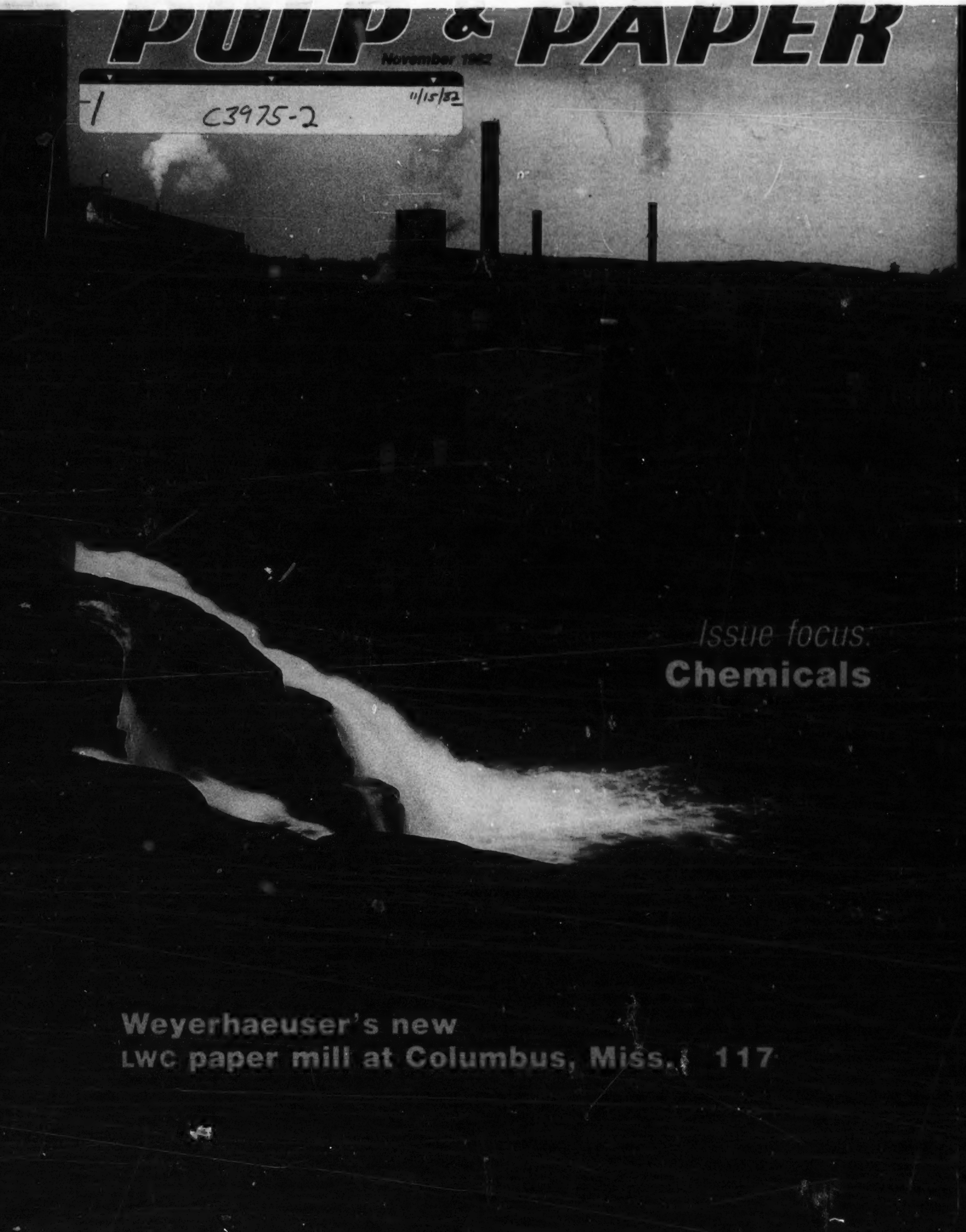

Issue focus:
Chemicals

Weyerhaeuser's new
LWC paper mill at Columbus, Miss. 117

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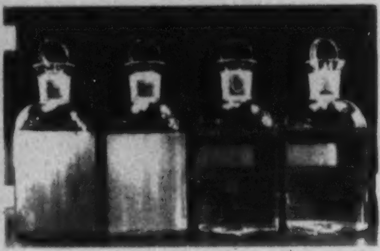
ISSUE FOCUS: Chemicals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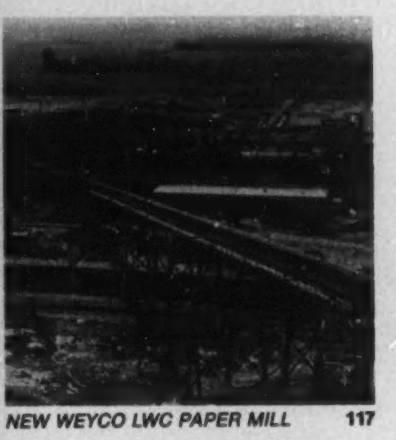
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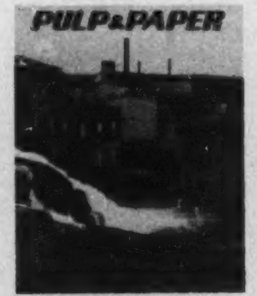

COVER: *Georgia-Pacific's Lyons Falls, N.Y., printing papers mill has begun converting its power boilers to wood fuel for an annual savings of over 200,000 bbl of oil (see story page 146). Photo by Gary Nash, courtesy of Rader Cos. Inc., Portland, Ore.*

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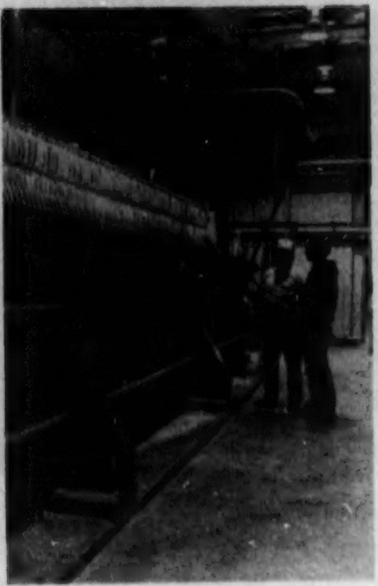
ABP BPA



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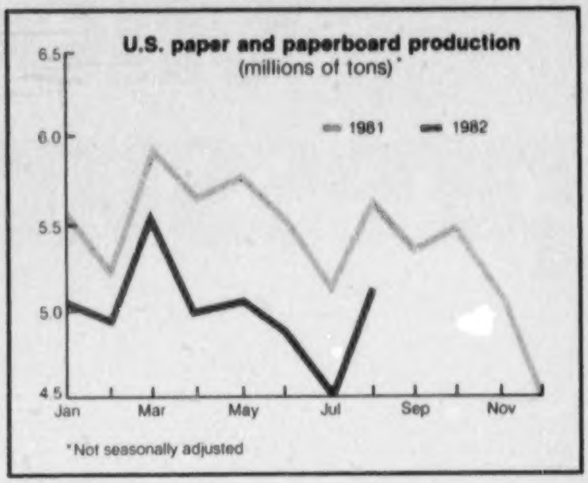
MONTH IN STATISTICS

U.S. paper and paperboard production in August totaled 5.1 million short tons, 4.8% below the August 1981 total, according to the American Paper Institute. Adjusted for seasonal and workday factors, the July-August production rate came to 58.8 million tpy, ahead of the second-quarter average of 57.8 million tpy but below the first-quarter average of 60.0 million tpy.

Among major grades, a modest uptrend was experienced in virtually all paper grades. On a seasonally adjusted basis, the August trend for printing/writing paper shipments was the highest for the year, API said. Packaging and industrial grades showed fairly strong growth in the month. Newsprint production, however, eased slightly in August. In paperboard, August unbleached kraft linerboard output was second only to the March level—supported to some extent by exports—but was still below year ago. Boxboard grades showed similar strength.

Total Canadian newsprint shipments in August came to 598,000 metric tons, down 8.4% from August 1981, according to the Canadian Pulp & Paper Assn. Newsprint mill operating rates climbed to 75% in August from 71% in July but were well below the 82% rate of a year earlier.


U.S. paper and paperboard production
(millions of tons)*

*Not seasonally adjusted

		Latest month (000 short tons)	% change from year ago	Annualized year-to-date (000 short tons)	% change from year ago
PAPER & PAPERBOARD PRODUCTION[1]					
Newsprint	August	410	−12.6	5,146	−1.6
Uncoated groundwood (s)	August	130	1.6	1,434	−2.9
Coated paper (s)	August	437	3.8	4,968	1.0
Uncoated free sheet (s)	August	650	0.2	7,792	−2.8
Unbleached kraft packaging and industrial (s)	August	326	−2.7	3,651	−8.1
Tissue	August	370	−6.8	4,395	−3.0
Total paper	**August**	**2,592**	**−2.9**	**30,345**	**−3.1**
Kraft linerboard, unbleached	August	1,206	−7.3	13,732	−8.7
Semichemical medium	August	349	−11.0	4,410	−9.5
Bleached paperboard	August	316	−5.1	3,767	−6.6
Recycled paperboard	August	572	−7.3	6,689	−7.4
Total paperboard	**August**	**2,543**	**−6.6**	**29,694**	**−8.1**
Total paper and paperboard*	**August**	**5,135**	**−4.8**	**60,039**	**−5.6**
PULP, WASTEPAPER & FIBER[2]					
Total woodpulp production	July	3,734	−8.5	50,118	−5.1
Market pulp production	July	382	−20.3	5,798	−6.3
Wastepaper consumption at paper/board mills	July	1,033	−7.4	13,665	−4.0
Pulpwood consumption (cords)	August	6,399	−1.9	79,114	−1.9
CONVERTED PRODUCTS STATISTICS[3]					
Corrugated box shipments (billion ft^3)	August	20.414	−1.9	156.614†	−6.2
Containerboard inventories at box plants	Aug. 1	2,594	9.5		
INTERNATIONAL TRADE[2]					
U.S. paper imports (including products)	July	585	−5.5	7,945	−6.2
Imports of Canadian newsprint	July	449	−10.0	6,592†	−6.3
U.S. paper exports (including products)	July	357	0.3	4,298	−13.8
Exports of unbleached kraft linerboard	August	170	32.8	1,932	−4.8
Exports of woodpulp	July	261	−13.0	3,512	−5.8
CANADIAN STATISTICS[4] (reported in metric tons)					
Total newsprint shipments	August	598	−8.4	5,358†	−8.3
Operating rates	August	75%	82%	85%	94%
Inventories held by U.S. consumers	Aug. 31	1,502	3.2		
Woodpulp shipments (export only)	August	489	29.7	3,927†	−12.5
Operating rates	August	72%	62%	80%	86%

1. American Paper Institute. 2. API, Bureau of Census, American Pulpwood Assn. 3. Fiber Box Assn., Paperboard Packaging Council. 4. Canadian Pulp & Paper Assn.
*Includes construction and wet machine grades. †Not annualized. ‡Not directly comparable to year ago because of coding change. (s) = shipments.

EMPLOYMENT

Second-quarter mill wages up a bit

Hourly wages of paper mill employees edged up in the second quarter from March levels to $10.82/hour. Weekly hours worked also rose slightly during the quarter while overtime hours held steady, bringing weekly paychecks to $477.16, up 3.8% from March levels, according to Bureau of Labor Statistics. Weekly earnings were up 6.5% over June 1981 levels.

Hourly wages also rose slightly for employees at paperboard container and box plants in the second quarter and, aided by small rises in weekly hours worked and overtime hours, brought weekly earnings to $331.70, a 3.7% rise over March levels and a 5.1% increase over year ago.

Production worker employment in the paper and allied products industry declined for the third quarter in a row and, at 489,000 workers, was 6.1% below year-earlier levels. Last year's employment peak was 525,000 workers in September.

The total number of women workers in the paper and allied products industry has steadily declined since its peak last September at 165,000 workers, and in May stood at 154,000 workers. The percentage of women workers has also fallen off slightly since September, down to 23.2% from 23.5%.

Average earnings and hours of production workers in the paper and allied products industry

	June 1982	Mar. 1982	% change for quarter	June 1981	% change year ago
Paper & allied (SIC 26)					
Hourly earnings	$9.27	$9.03	2.7%	$8.54	8.5%
Weekly hours	42.0	41.7	0.7	42.7	−1.6
Overtime hours	3.9	3.9	—	4.6	−15.2
Weekly earnings	389.34	376.55	3.4	364.66	6.8
Pulp & paper mills*					
Hourly earnings	$10.82	$10.50	3.0%	$9.98	8.4%
Weekly hours	44.1	43.8	0.7	44.9	−1.8
Overtime hours	5.7	5.7	—	6.3	−9.5
Weekly earnings	477.16	459.90	3.8	448.10	6.5
Paperboard containers & boxes					
Hourly earnings	$8.13	$7.94	2.4%	$7.50	8.4%
Weekly hours	40.8	40.6	0.5	42.1	−3.1
Overtime hours	2.9	2.8	3.6	3.6	−19.4
Weekly earnings	331.70	319.98	3.7	315.75	5.1

*Does not include figures for paperboard mills, which are similar.
Source: Dept. of Labor, Bureau of Labor Statistics

MERGERS

Diamond completes sale to Smurfit

Diamond International Corp. has concluded its sale of the assets of its packaging products, corrugated container, paperboard and graphic arts divisions to Jefferson Smurfit Group in a joint venture with Don J. Hindman and Clark Holdings Inc. of Chicago (P&P, Oct., p. 29).

The purchase price was about $80 million in cash, plus the assumption of certain liabilities. In 1981, the four divisions had aggregate sales of $190 million and income before taxes of $8.5 million.

Hammermill buys Millers Falls Paper

Hammermill Paper Co. has agreed to acquire Millers Falls Paper Co. from EG&G Inc. through an exchange of stock. Hammermill will operate the 30-tpd white paper mill in western Massachusetts as part if its Strathmore Paper Div.

Millers Falls Paper was profitable on sales last year of about $12 million. The mill produces cotton-content and sulfite bonds, onionskin, erasable, and technical papers on two 94-in. fourdrinier machines.

Strathmore already operates three mills in Massachusetts producing similar grades at Westfield, Woronoco, and Turners Falls, with a combined capacity of around 100 tpd. As part of a modernization program that will raise capacity by 40%, the division rebuilt one of its machines last year and has two more rebuilds scheduled for 1982-83.

WOOD PRODUCTS

G-P reopens idled plywood mill

Georgia-Pacific Corp. resumed production at its plywood plant at Logansport, La., Sept. 27, one year after 300 plant workers were laid off and the facility closed because of the depressed home building industry. The decision to reopen was based on "company marketing strategy, product sales, and the price and availability of raw materials needed for production," G-P explained.

Furloughed workers were recalled and full production output was expected to be reached within two weeks after startup, the company said. Plant capacity is 180 million ft^3/year.

Housing starts down 16% in August

Following a 34% jump in housing starts in July, August housing starts slumped 16.2% in August from the previous month to a seasonally adjusted annual rate of 1.195 million units, according to the Dept. of Commerce. Most of the August drop was due to a 31% decline in multifamily construction starts, while single-family units declined 2.4%. In July, multifamily unit starts more than doubled, aided by federal funds made available for government-subsidized construction.

Building permits also fell 16.6% in August, but the drop probably was due to builders waiting until October to seek permits to build more government-subsidized apartments. Dept. of Housing & Urban Development recently released funds for about 30,000 such units.

- **A new study** by the General Accounting Office reports there are "no quick fixes" to the severe problems of the home building industry. The study, delivered to Congress, says the demand for housing will increase "when interest rates decline substantially, provided it is accompanied by healthy levels of employment and growth in real personal income."

The study noted that imposing a duty on lumber imports from Canada might yield some short-term relief, but could entail trade repercussions and risk loss of future supplies of Canadian lumber. And any housing stimulus proposals under consideration by Congress must begin quickly, GAO claimed.

Construction paper and board: Recovery in housing in 1983 should aid ailing industry

U.S. Statistics	**1980**	**1981**	**1982e**
Construction papers			
Production, 000 tons*	1369	1150	1000
Capacity, 000 tons	2345	2272	2243
Imports, 000 tons	148	140	135
Exports, 000 tons	23	17	15
Apparent U.S. consumption, 000 tons	1494	1273	1120
Construction boards[1]			
Production, 000 tons	3020	2706	2400
Capacity, 000 tons	4389	4382	4349
Imports, 000 tons	210	231	242
Exports, 000 tons	55	108	160
Apparent U.S. consumption, 000 tons	3175	2829	2502

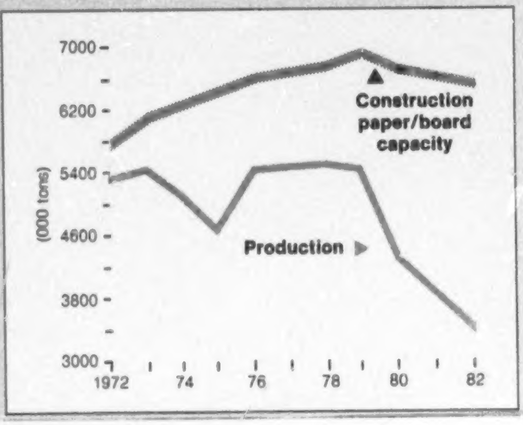
[1] Includes insulating and hardpressed boards; does not include wet machine boards [e]estimated *All tons are short tons

Grade structure: Most construction papers are used to make felts for asphalt roofing tiles. Other applications include felts for cars and flooring, as well as sheathing and insulation. Insulation boards are used for wallboard, sheathing, ceiling tiles, and insulation deck board. Hardpressed boards—made from defibrated woodpulp and not generally considered a product of the paper industry—are usually denser than 31 lb/ft³. Uses include cabinets and wall paneling.

Production/capacity: Construction papers: In 1982, production is expected to drop to about one million tons, the lowest point in more than a decade and 15% lower than 1981's output of 1.15 million tons. Capacity for construction papers, which has been declining gradually for several years, is expected to drop slightly again in 1982 to 2.243 million tpy from 2.272 million tpy in 1981.

Construction boards: For 1982, construction board production will decline to 2.4 million tons, another record low point reached in this market. This represents a drop of 13% from 1981's output of 2.7 million. Production of insulating boards declined to 846,000 tons in 1981, 24% lower than the one million tons made in 1980. Hardpressed board production also dropped to an estimated 1.86 million tons made in 1981 compared with nearly 2 million tons in the previous year.

Construction board capacity is expected to remain relatively unchanged through 1983 at about 4.3 million tpy, with hardpressed board representing about 2.5 million of that.



Estimated capacities for producers of construction papers:	**Annual U.S. capacity** (000 short tons)	**Capacity share** (%)
1. Celotex Corp.	281	12.5
2. Genstar Building Materials	190	8.5
3. GAF Corp.	166	7.4
4. Tamko Asphalt Products	137	6.1
5. Manville Corp.	123	5.5
6. Certain-Teed Corp.	120	5.3
7. Owens-Corning Fiberglas	54	2.4
8. Georgia-Pacific Corp.	45	2.0

U.S. capacity (1982): **2.243 million tons**
Capacity share of top five companies: 40.0%

Estimated capacities of insulation board companies:	**Annual U.S. capacity** (000 short tons)	**Capacity share** (%)
1. Celotex Corp.	365	20.3
2. Boise Cascade Corp.	154	8.6
3. U.S. Gypsum Co.	130	7.2
4. National Gypsum Co.	119	6.6
5. Conwed Corp.	95	5.3
6. Manville Corp.	95	5.3
7. Owens-Corning Fiberglas	81	4.5
8. Temple-Eastex Inc.	16	0.9

U.S. capacity (1982): **1.799 million tons**
Capacity share of top five companies: 48.0%

Masonite is the major producer of hardboard with an estimated 39% of the market, followed by Abitibi-Price Inc. (14.5%), Celotex Corp. (8.8%), Superwood Corp. (7.7%), Champion International Corp. (5.7%), and Georgia-Pacific Corp. (5.7%).

Outlook: Demand for construction paper and board relies heavily on building activity, especially residential housing starts, as well as the level of home repair and retrofitting. In 1981, just 1.1 million new homes were built, the lowest level since 1946, and 1982 is expected to be relatively flat with just over a million new housing starts anticipated. A peak was achieved in 1979 when work was begun on 1.75 million new homes. In 1983, new housing starts should reach 1.3 million.

High interest rates were the chief barrier to more housing activity in the early 1980s, but observers say mortgage rates will drop about three points to near 14% in 1983. But other factors should put a lid on the market for some time. In addition to a trend toward building smaller houses that require less materials, competition from new products will also lower output. Fiberglass mat, which had an estimated 20% market share in 1981, should have about a 60% share by 1984-85, analysts say. Single-ply rubber roofing products are also making inroads into roofing. In the insulation market, inorganic materials such as foams should continue to displace such paper-based products as fiberboard insulation sheathing.

Pricing: Wholesale price index of building papers and board (1967-100); 1970, 101.2; 1972, 106.4; 1974, 123.5; 1975, 127.1; 1976, 138.8; 1977, 157; 1978, 187; 1979, 182; 1980, 206; 1981, 232; 1982, 240e.

Markets: Most construction papers/boards are converted into building products. Output by tonnage: construction papers, 30%; insulation board, 22%; hardpressed board, 48%.

Pulp/paper industry chemicals

PULP & PAPER's annual survey of chemical supply and prices indicates that demand is down; prices are somewhat weak, but rising

By BARRY SHOCKETT

☐ This has been a year of reduced demand for many chemicals used by the U.S. pulp and paper industry, leading in many cases to substantial discounting. A reduction in the transaction price of a number of chemicals is reflected by the year-to-year decrease in the industrial chemicals index (see Figure 1). In July 1982, the index was 349.7 compared with 370.4 a year ago. A similar turnaround in the fuels and power index was also reflected in lower petrochemical feedstock prices, although there were some exceptions.

For example, diethylenetriamine, used with wet-strength resins, has not decreased in price this year despite a sharp drop in the price of ethylene. Wet-strength resin prices have therefore continued to increase in 1982.

Pulp mill chemical demand in 1982 was depressed in most cases as pulp production has dropped off. By the end of July, output was down 4.5% over the corresponding 1981 period. As a result, 1982 usage of saltcake, soda ash, and sodium chlorate is below last year's levels.

Hydrogen peroxide usage is apparently breaking the general downward consumption trend for chemicals. Approximately 23% more H_2O_2 will be used by mills in 1982 than 1981. This is also the case in the Canadian market.

The chloralkali market has probably been affected most by the recession. The major end-use for caustic, the aluminum industry, is depressed in the U.S. and in offshore markets. Exports were down almost 50% by midyear, compared to 1981 levels.

According to the Chlorine Institute, the average operating rate of the chloralkali industry for the first seven months in 1982 was 65% (5.6 million tons vs 6.7 million tons in 1981). Even though operating rates are low, the downturn in demand (particularly in aluminum) has produced a surplus of caustic soda, which is a significant turnaround compared to the first half of 1981.

Chlorine fared slightly better than its coproduct, caustic, with total demand down only 7% in 1982. Caustic demand was down 10%, even though discounting has been heavier and more prolonged. Some economists are predicting an increase in housing starts for 1983 of almost 35% and a boost in North American automotive production of about 22.5%. Both of these markets normally consume substantial quantities of polyvinyl chloride (PVC),

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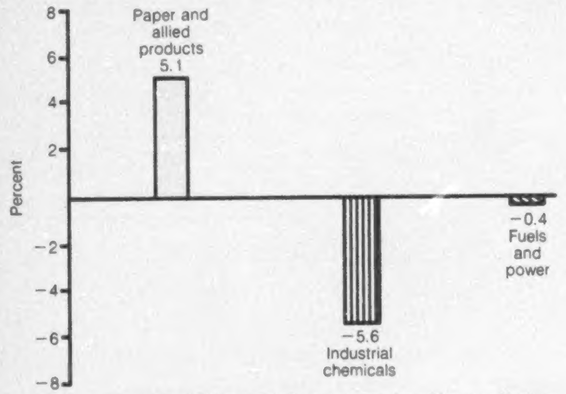
Mr. Shockett is consulting editor-chemical markets for PULP & PAPER.

FIGURE 1: **U.S. price increases for 1982***



* Only the paper and allied products index experienced a year-to-year increase during the first seven months of 1982.

Source: Wholesale price indexes, Bureau of Labor Statistics

supply, pricing

for which chlorine is a key precursor. If these markets revive, chlorine demand should surge.

Sulfur, the other chemical used in substantial quantities by the paper industry—besides caustic—that had been in short supply until last year, is also readily available. The downturn in its major customer, the fertilizer industry, has weakened demand considerably. Frasch and recovered sulfur production was down 14% in the first half of 1982 to 9.17 million metric tons (from 10.66 million for the same period last year).

Sulfur exports and imports were also down significantly at mid-year.

Production of most paper grades was down substantially in the first seven months of 1982. Coated papers output was barely ahead of last year's January-July period (0.4%) and, as a result, demand for both kaolin clay and starch will be down this year.

The sharp drop in paperboard output—almost 8.5% less in 1982 after seven months than in the previous year—will result in reduced requirements for latices, rosin size, and wet-strength additives as well.

DEFINITIONS OF SURVEY AVAILABILITY TERMS:

Very tight—On allocation or demand significantly greater than supply

Tight—Demand slightly greater than supply

Market—Supply and demand in balance, or excess capacity available

Calcium carbonate

Uses: About 85% of the calcium carbonate ($CaCO_3$) used in the paper industry is for coating, with the balance used as filler. Precipitated grades are used in about 70% of the applications, but ground natural carbonate continues to find increased usage as finer grades are introduced.

Demand: In 1981, the paper industry consumed an estimated 140,000 tons of $CaCo_3$. Although industry output was down almost 6% in the first half of 1982, the move by several mills to alkaline papermaking will help boost carbonate consumption to 140,000 to 150,000 tons this year. Other major uses include plastics, coatings, and refractories.

Sources: Producers are listed in the P&P *Buyers Guide 1982*, p. 32, "Register of coating and filler pigments."

Availability: 1982, market; 1981, market; 1980, market; 1979, market; 1978, market.

Pricing: Precipitated: 1982, $105-$170/ton, bulk, f.o.b. works; 1981, $95-$160/ton; 1980, $105-$135/ton; 1979, $98-$123/ton; 1978, $95-$133/ton. Ground, medium (15-micron): 1982, $105-$108/ton, bags, truckload, f.o.b. works; 1981, $95-$100/ton; 1980, $90-$95/ton; 1979, $82-$83/ton; 1978, $66-$76/ton.

Forecast: Precipitated carbonate prices rose about 6% in 1982 and should experience a similar increase next year. Medium-ground $CaCO_3$, on the other hand, increased about 8% in price and is expected to go up between 7% and 8% in 1983.

Caustic soda

Uses: Most of the caustic soda (sodium hydroxide) consumed by the pulp and paper industry is used by kraft and bleached sulfite pulp mills, mainly for caustic extraction in the bleach plant. Kraft and semichemical (NSSC) mills also employ some caustic for sodium oxide makeup. Organic and inorganic chemical production, textiles, and aluminum processing are other important uses.

Demand: Pulp mills in 1981 consumed an estimated 1.9 million tons of sodium hydroxide, or 17% of the 11.3 million tons produced. Mill consumption in 1982 is predicted to be down to about 1.7 million tons, with total caustic production for 1982 forecast to be about 10.2 million tons (down 10% from 1981). Organic and inorganic chemicals together use over 50% of the total, while textiles and aluminum processing each employ about 6%.

Sources: Caustic soda is a coproduct of chlorine production. See chlorine profile for major producers.

Availability: 1982, tight to market; 1981, very tight to tight; 1980, very tight; 1979, market; 1978, market.

Pricing: 1982, $315/ton, 50% solution, f.o.b. works, freight equalized; 1981, $270-$320/ton; 1980, $167-$200/ton; 1979, $130-$160/ton; 1978, $160-$170/ton.

Forecast: Caustic prices are also being discounted, but not to the same extent as chlorine prices. There have been reports of the selling price ranging between $190/ and $220/ton, but most caustic is sold at about $240/ton (about 24% below list). If the economy turns around in 1983 as predicted, the market price could increase about 30% during the year. Usually caustic soda supplies are adequate when chlorine demand is up. However, during most of 1982, caustic demand itself has been down substantially. With the predicted economic recovery next year, caustic supply could tighten up in the latter part of 1983. Pulp mill usage of caustic for 1983 is expected to increase between 5% to 6% and reach the 1.9-million-ton level.

Chlorine

Uses: The major end use for chlorine in the pulp and paper industry is as a bleaching agent in both kraft and sulfite pulp mills. Small quantities of chlorine are also employed for on-site manufacture of calcium or sodium hypochlorite used to bleach chemical or mechanical pulps.

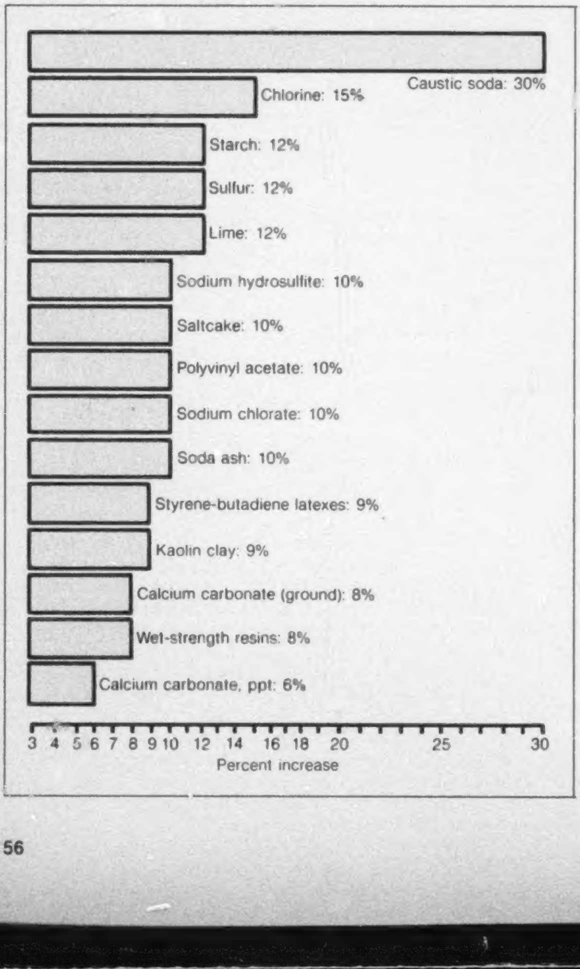
Demand: In 1981, chlorine demand by the pulp and paper industry was an estimated 1.4 million tons, about 13% of total production of 10.8 million tons. In 1982, mill consumption is expected to be about 1.3 million tons. Other major outlets include ethylene dichloride (EDC)—the intermediate for vinyl chloride monomer (VCM) manufacture—inorganic and organic chemicals, and municipal and industrial water treatment. Manufacture of EDC accounts for about 21% of the total.

Sources: There are approximately 25 companies in the U.S. making chlorine and caustic together by the electrolytic reduction of brine. (Relatively small quantities of chlorine are also produced by oxidation or electrolysis of hydrochloric acid.) The major chloralkali producers (in decreasing order of nameplate capacity) include: Dow Chemical, PPG Industries, Diamond Shamrock, Hooker Chemicals, Olin, Georgia-Pacific, Vulcan Materials, and Pennwalt. Dow Chemical closed its Midland facility in June 1982, while other producers with several plants may follow suit to rationalize production among their other facilities. Alcoa's revamped 398-tpd facility (based on caustic), slated to reopen in the spring of 1982, is still closed because of the downturn in the aluminum industry.

Availability: 1982, market; 1981, market; 1980, market; 1979, tight to very tight; 1978, market.

Pricing: 1982, $145/ton, f.o.b. works, freight equalized; 1981, $145/ton; 1980, $145/ton; 1979, $135-$150/ton; 1978, $135-$145/ton.

FIGURE 2: **Projected U.S. price increases for major chemicals in 1983**



Forecast: Chlorine's list price has been meaningless since early in 1981, with actual selling prices ranging between $80-$110/ton, considerably different from the list price. Most chlorine tonnage apparently moves at about the $100/ton level. Over the last two years there have been several attempts by various suppliers to boost the off-list price—three in 1981 and two this past summer. The third try in 1982 was lead by Olin, which instituted a $20/ton hike effective in early September for spot sales. Four more producers subsequently announced a similar increase. If this boost holds, the gap between list price and off-list price may be closed sometime next year, assuming that chlorine demand begins to turn around by the first quarter of 1983. However, there is considerable resistance by chlorine consumers at this time to accept the increase, which may have to be reduced by $10/ton.

Although over the long term, chlorine usage by pulp mills will decrease gradually—under pressure of continued ClO_2 substitution—demand in 1983 is expected to return to the 1981 consumption level (1.4 million tons).

Hydrogen peroxide

Uses: Hydrogen perodixe (H_2O_2) is traditionally used in the pulp and paper industry primarily as a bleaching agent for chemical and mechanical pulps. It is also employed in the deinking of recycled newsprint.

Demand: In 1981, the pulp and paper industry used an estimated 13,000 tons, about 12% of total consumption (107,000 tons). Peroxide's major use is as a chemical intermediate, consuming 25% to 30% of the market. Other applications include textiles, municipal water and waste treatment, industrial effluent treatment, and uranium mining.

Sources: In descending order of capacity, the four U.S. H_2O_2 producers are: E.I. duPont, FMC, Interox America, and PPG. FMC is expanding its Bayport, Texas, plant by 10,000 tpy, due onstream in 1984.

Availability: 1982, market; 1981, market; 1980, market; 1979, market; 1978, market.

Pricing: 1982, 39.5¢/lb, 70% solution, f.o.b. producing point, freight equalized; 1981, 35.6¢-39.5¢/lb; 1980, 35.5¢-36.5¢/lb; 1979, 32.5¢/lb; 1978, 28¢/lb.

Forecast: Total apparent consumption in 1982 will only increase to 108,000 tons. Paper industry usage should reach 16,000 tons, a 23% jump over 1981. Over the long term, pulp mill demand should increase an average of 10%/year, and total peroxide demand 8%/year. The use of H_2O_2 in industrial waste treatment, a relatively new outlet, is expected to grow between 8% to 9%/year, and offset somewhat slumping uranium mining demand.

Kaolin clay

Uses: Kaolin clays are employed in a wide range of paper and board grades as both filler and coating pigments. Coating applications account for about 54% of industry usage.

Demand: An estimated 3 million tpy of kaolin is used by the paper industry, about 75% of total kaolin consumption. Usage in 1982 is expected to be down about 100,000 tons. Approximate usage by grades: Nos. 1 and 2, 24%; water-washed, 22%; Nos. 3 and 4, 16%; delaminated, 13%; high-brightness and air-float, 10% each; and other, 5%. The next-largest end use is by the ceramics industry (20%), with the remaining 5% used in paints, rubber, refractories, and the like.

Sources: Producers are listed in the P&P *Buyers Guide*

1982, p. 32, "Register of coating and filler pigments."

Availability: 1982, market; 1981, market; 1980, market; 1979, market to tight.

Pricing: Premium No. 1 coating: 1982, $142/ton, f.o.b. Ga.; 1981, $130/ton; 1980, $118/ton; 1979, $108/ton; 1978, $98/ton. Water-washed No. 1 coating: 1982, $99.5/ton (same basis); 1981, $91.50/ton; 1980, $84/ton; 1979, $76/ton; 1978, $61.5/ton. Dry-ground filler grade (same basis): 1982, $61/ton; 1981, $56/ton; 1980, $51/ton; 1979, $35-$44/ton; 1978, $30-$35/ton.

Forecast: Kaolin usage is down this year because of the drop in output of both paper and paperboard. By the end of July, production was down almost 6% (compared with last year's seven-month period). In 1983, the total demand for both uncoated and coated papers is expected to be up about 6.5%, thus bringing paper industry usage of kaolin back to the 1981 level.

Lime

Uses: The kraft mill operator requires a low-cost alkali to causticize the sodium carbonate in the green liquor. Lime, being the cheapest alkali available (between 2¢-3¢/lb), is therefore basic to the soda/lime route to free caustic. Kraft mills produce reburned lime on-site.

Demand: In 1981, the pulp and paper industry used about 990,000 tons of lime, about 5% of total lime consumption of 19.5 to 20 million tons. In 1982, demand and mill usage will be basically flat. The steel industry used 37% of the total, with other applications being sewage treatment, chemicals, and sugar refining.

Sources: The major merchant manufacturers, produced mainly from calcite ($CaCO_3$) or dolomite ($CaMgCO_{32}$) are Domtar Industries, Genstar (formerly Flintkote), Kerr-McGee, Marblehead Lime, Martin Marietta Chemicals, Mississippi Lime, Pfizer, Steetley Industries, and U.S. Gypsum. (Steetley pruchased the Tacoma, Wash., plant of Domtar early in 1981.)

Availability: 1982, market; 1981, market; 1980, market; 1979, tight in eastern U.S., market in West; 1978, market to tight.

Pricing: Quicklime: 1982, $57.80/ton, f.o.b. plant; 1981, $51.63/ton; 1980, $46.10/ton; 1979, $41.16/ton; 1978, $36.75/ton.

Forecast: Improvements in construction and steel markets in 1983 may bring demand back close to the level reported in 1979 (21 million tons). Lime prices should increase between 11% and 12% in 1983.

Polyvinyl alcohol

Uses: Polyvinyl alcohol (PVA) is employed by the paper industry mainly as a surface size for printing and writing papers and paperboard, and as a coating binder.

Demand: In 1981, paper industry usage of PVA was between 10.5 and 11 million lb, about 8% of the total merchant demand of about 136 million lb. Production last year, excluding that required in the manufacture of polyvinyl butyral (PVB), was 144.5 million lb. In 1982, demand by paper and board mills is expected to decrease to between 9 to 10 million lb, while total consumption will be between 115 and 120 million lb. Imports in 1981 reached 24 million lb, and at the end of July 1982 were approaching an annual rate of 21.5 million lb. PVA's largest end use is by the textile industry (about 50% of total demand), followed by adhesives (25%) and emulsifiers (12%).

Sources: In descending order of capacity, the three U.S. producers of PVA, derived from the hydrolysis of polyvinyl acetate, are: E.I. duPont, Air Products & Chemicals, and Monsanto. Monsanto produces only partially hydrolyzed PVA; Air Products & Chemicals makes both fully and partially hydrolyzed product. DuPont's 50% expansion of its Laporte, Texas, plant will allow the manufacture of partially hydrolyzed grade when the project is completed in 1984.

Availability: 1982, market; 1981, market; 1980, market; 1979, market; 1978, market.

Pricing: 1982, $1.05/lb, delivered basis; 1981, $1.00-$1.05/lb; 1980, 86.5¢-91.5¢/lb; 1979, 77.5¢/lb; 1978, 69.5¢/lb.

Forecast: PVA demand by the paper industry should grow around 3% to 4% in 1983. However, growth in overall demand is uncertain, but should increase 2.5%/year conservatively and could grow 6.5%/year in a strong economy.

Saltcake

Uses: Saltcake (sodium sulfate) is the main source of makeup sodium and sulfur values in kraft pulp mills.

Demand: In 1981, kraft pulp mills used an estimated 612,000 tons of saltcake, about 48.5% of the total consumption of 1.3 million tons Mill usage in 1982 is expected to be slightly less. Other end uses include: detergent industry, 39%; and glass manufacture, 12.5%.

Sources: Sodium sulfate is produced from both natural deposits or as a byproduct in the manufacture of rayon, sodium bichromate, and hydrochloric acid. Until this year, natural sulfate capacity was about 52% of the total, but this dropped to 45.5% in 1982 when Kerr-McGee closed its Trona, Calif., facility. Major producers of natural saltcake include: Great Salt Lake, Kerr-McGee, and Ozark-Mahoning, while the major synthetic producers are: Allied, Akzona, Avtex, Climax Chemical, Diamond Shamrock, Koppers, and Morton. In 1981, imports from Canada were about 16% ahead of 1980, and a similar increase should occur in 1982.

Availability: 1982, market; 1981, market; 1980, tight to market; 1979, market to tight; 1978, market.

Pricing: 1982, $79-$80/ton, f.o.b. plant; 1981, $68-$79/ton; 1980 $60-$68/ton; 1979, $47-$52/ton; 1978, $35-$45/ton. Prices are regional, being slightly higher on the West Coast.

Forecast: Mill demand should increase if operating rates begin to rise again in 1983. However, the long-term prospects for pulp mill saltcake consumption depends on the extent of chlorine-dioxide substitution in the first bleaching stage. The effluent from ClO_2 generators contains sodium and sulfur values that can be used in place of purchased saltcake. An improved economy in 1983 could result in a saltcake price boost of about 10%. Ozark is involved in a two-year expansion program that will increase capacity at its Seagraves, Texas, plant by 50%.

Sodium chlorate

Uses: The major use of sodium chlorate is for on-site generation of chlorine dioxide (ClO_2).

Demand: In 1981, pulp mills used an estimated 283,000 tons of Na_2ClO_3, about 82% of total apparent consumption of 345,000 tons. Mill demand should increase slightly in 1982 to about 290,000 tons. Other uses are: chlorates (7%), uranium processing (5%), agriculture

(4%), and miscellaneous applications (25%).

Sources: The major producers of sodium chlorate—derived from electrolysis of an acidified sodium chlorate solution—include ERCO Industries, Georgia-Pacific, Kerr-McGee, Occidental Chemical's Cooker Div., Olin, and Pennwalt. Smaller facilities are operated by Brunswick Chemical, Huron Chemicals, and Pacific Engineering. Canadian imports now account for about 22% of total chlorate demand.

Availability: 1982, market; 1981, market; 1980, market; 1979, market; 1978, tight.

Pricing: 1982, $420/ton, f.o.b. works, freight equalized; 1981, $375/ton; 1980, $345-$375/ton; 1979, $335-$345/ton. In the first half of 1982, the list price was discounted by $45/ton, but on July 1 the discount was removed for contract customers. One producer lists its chlorate at $440/ton but is reportedly matching the lower price.

Forecast: Pennwalt expanded its Tacoma, Wash., plant earlier this year (by 50%), while Kerr-McGee's planned expansion at Hamilton, Miss., will increase its capacity there by 30% in mid-1983. The additional capacity may partially offset growing imports from Canada, although by mid-decade Canadian capacity will be close to 500,000 tpy.

Sodium hydrosulfite

Uses: Sodium hydrosulfite is used as a bleaching agent for mechanical and deinked pulp.

Demand: In 1981, the paper industry used an estimated 16,700 tons (excluding hydrosulfite produced on-site from Borol). Apparent consumption was close to 56,000 tons. The textile industry is the largest consumer of sodium hydrosulfite (used in vat dyeing) and accounts for about 40% of total demand. Other end uses include clay bleaching (20%), and miscellaneous.

Sources: There are now two sodium hydrosulfite producers left in the U.S., Olin and Virginia Chemicals, Virginia having acquired Royce Chemical in late 1981. Virginia recently announced that it would close the Royce plant permanently. Borol solution is produced by Morton Thiokol's Ventron Div.

Availability: 1982, market; 1981, market; 1980, market; 1979, market; 1978, market.

Pricing: 1982, 60¢/lb (proprietary blends), f.o.b. producing point; 1981, 55¢-60¢/lb; 1980, 43.5¢-55¢/lb; 1979, 41.5¢-43.5¢/lb; 1978, 39.5¢-41.5¢/lb

Forecast: Sodium hydrosulfite consumption in 1982 may be slightly higher than last year, despite the downturn in the newsprint field. Hydrosulfite produced via Borol should also be ahead of the estimated 8000 tons (100% basis) employed by the mills in 1981.

Starch

Uses: Starches are the workhorse binders for the coating mills, and are also used as surface sizes, internal additives, and as an adhesive for corrugated containers.

Demand: In 1981, total starch consumption was between 4.0 and 4.5 billion lb, with 3 billion lb used by the paper industry. In 1982, mill usage will drop to 2.8 billion lb, while total demand will be down to between 4.1 and 4.2 billion lb. Food, brewing, and textiles are other major end uses for starch.

Sources: Producers are listed in the P&P *Buyers Guide 1981*, pp. 32-43. About 90% of the starch used in the paper industry is corn starch.

Availability: Unmodified: 1982, market; 1981, market; 1980, market; 1979, market. Modified: 1982, market; 1981, tight to market; 1980, tight; 1979, tight to market.

Pricing: Unmodified: 1982, $11.50-$12.25/100 lb, bags, truckload, f.o.b. plant; 1981, $11.25-$14/100 lb; 1980, $9.50-$10.50/100 lb; 1979, $9-$10/100 lb; 1978, $8/100 lb. (For bulk prices deduct $1.25/100 lb.) Modified starch prices vary for each grade, but generally follow price trends of unmodified starch.

Forecast: Two consecutive record corn crops have resulted in reduced starch prices in 1982. The $11.50/100 lb price should remain in effect for the balance of the year. However, farm support legislation expected in 1983 will most likely result in a price boost of about 10%. Both starch and high-fructose corn syrup (HFCS) supply is more than adequate to handle demand for the foreseeable future. A.E. Staley brought on a new plant in Tenn. Staley, which acquired the corn-processing operations of Anheuser-Busch in late 1981, increased its HFCS capacity by 1 billion lb (to 2.3 billion lb). Starch demand by the mills is expected to return in 1983 to the 1981 level (3 billion lb).

Styrene-butadiene latex

Uses: The bulk (about 90%) of the styrene-butadiene (SB) latex employed by the paper industry is used as a coating binder, with the remaining 10% used for paper saturation (such as wallpaper).

Demand: In 1981, about 220 million lb of SB latex were used by the paper industry, 38% of total latex consumption of 585 million lb. In 1982, usage should reach 225,000 lb. The major end use is in carpetbacking and integral foam. Other textile applications and adhesives account for the remaining 12%.

Sources: At least 80% of the estimated 915 million lb of annual capacity in the U.S. is shared by four major suppliers: Dow Chemical, Polysar, Reichhold, and General Tire (in descending order to nameplate capacity). Polysar acquired Arco Chemical and GAF latex operations, boosting them to the second spot.

Availability: 1982, market; 1981, market; 1980, market; 1979, market; 1978, market.

Pricing: 1982, 71¢/lb; 1981, 65¢-71¢/lb; 1980, 59¢/lb; 1979, 53¢/lb; 1978, 40¢-43¢/lb.

Forecast: Feedstock costs are reduced compared to 1981, particularly styrene monomer, which has been discounted heavily in 1982. Both ethylene and benzene prices have also been depressed, although there have been recent attempts to raise the ethylene market price. Butadiene has been discounted as much as 6¢/lb. Decreased demand this year for lead-free gasoline has kept the price of benzene below $1.60/gal. As a result, there should be no change this year in the SB list price, however in 1983, prices will probably increase around 9%.

Sulfur

Uses: Sulfite pulp mills consume the bulk of the sulfur used by the pulp and paper industry. Some is also used directly in kraft pulp mills.

Demand: Pulp mills used less than 1% of the total sulfur consumed in 1981, requiring about 100,000 metric tons. (Total consumption was over 11.5 million tons.) The bulk of the sulfur purchased is for fertilizer and sulfuric acid production, the latter end use accounting for about 80% of total demand.

Sources: About 58% of elemental sulfur produced in the U.S. is via the Frasch route, with most of the balance coming from refineries and sour natural gas production. Major Frasch producers include Duval, Freeport, and Texasgulf. Major suppliers among the 60 or so firms recovering sulfur include Atlantic Richfield, Exxon, Getty, Mobil, Pursue Gas, Standard, Texaco, and Union Oil.

Availability: 1982, market; 1981, tight to market; 1980, tight; 1979, very tight; 1978, market to tight.

Pricing: 1982, $133.5/metric ton, crude, bright, f.o.b. Gulf Coast ports; 1981, $131.35-$138.73/metric ton; 1980, $103.31-$109.05/metric ton; 1979, $70.60/metric ton; 1978, $61.5/metric ton. U.S. recovered sulfur prices had been $15-$20/ton below Frasch levels, but are now about $8-$9/ton less. Reportedly, in some areas recovered sulfur prices are only $4/ton under the Frasch price. Currently, Canadian recovered sulfur is listed US$80-$85/metric ton f.o.b. Alberta producing points.

Forecast: The 1.3 million tons added to both Frasch and recovered sulfur capacity since 1980, coupled with poor fertilizer markets, has resulted in significant easing of supply. Some Frasch mines are running at low operating rates with no prospects of major improvements in the immediate future. A 10% boost in sulfur prices could occur if fertilizer markets improve in 1983.

Titanium dioxide

Uses: Both rutile and anatase grades of titanium dioxide (TiO_2) are employed by the fine paper and board mills, as a filler and in coating.

Demand: Demand for TiO_2 in 1982 will probably be down to between 165,000 to 170,000 tons. In 1981, the paper industry used about 183,000 tons out of an estimated total consumption of 814,500 tons. The paint industry now accounts for about 50% of total TiO_2 demand. Other end uses include plastics (10% to 12%), rubber, and ceramics.

Sources: Since NL Chemicals closed its TiO_2 plant in September, there are now five producers: American Cyanamid, E.I. duPont, Gulf & Western, Kerr-McGee, and SCM Glidden. About 75% of the TiO_2 produced in the U.S. is via the chlorine route, with the balance made by the sulfate process.

Availability: 1982, anatase/rutile, market; 1981, anatase/rutile, market; 1980, anatase/rutile, market; 1979, anatase/rutile, tight.

Pricing: 1982, anatase, 70¢/lb, delivered; rutile, 75¢/lb; 1981, anatase, 58¢-70¢/lb; rutile, 63¢-75¢/lb; 1980, anatase and rutile, 57¢/lb; 1979, anatase, 53¢/lb; rutile, 59¢/lb; 1978, anatase, 46¢/lb; rutile, 52¢/lb.

Forecast: DuPont has announced it will increase capacity to produce paper-grade rutile slurry at its Edgemoor, Del., plant by 70% by mid-1983. The plant's nameplate capacity of 110,000 tpy will remain unchanged.

Other major chemicals

Alum: Demand for alum has been off slightly in 1982 and prices have held steady for more than a year. Liquid alum is still selling at $133/ton in the North, $148.55/ton in the Northeast (New England), and $126/ton in the South. No increases are expected until next year, when an 8% to 10% boost may come about.

Casein: Since February 1982, the list price of the industrial casein has remained steady at $1.36/lb. Some price softening is expected by the end of the year.

Polyethylene: One of the few low-density polyethylene resin grades that has not been subject to severe discounting in 1982, extrusion-coating grade, is still listing at 45¢/lb, unchanged from the third quarter of 1981. If the reported turnaround in precursor ethylene prices continues, a 5% to 6% price hike could occur in 1983.

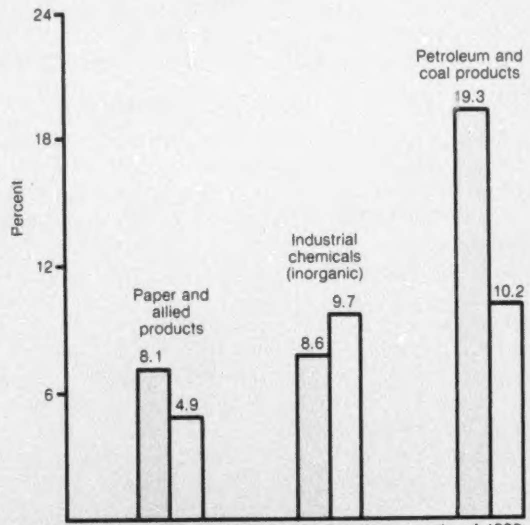
Polyvinyl acetate: Under the pressure of reduced monomer (VAM) prices, polyvinyl acetate prices are being discounted between 15% to 20% off the posted list price of 34¢/lb. Copolymer PVA_C has been selling for as low as 28¢/lb. Improvement in demand (down about 15% for the first seven months in 1982) and selling price is not anticipated until late in the year. A 10% price hike is expected for 1983.

Rosin sizes: Under pressure from decreased demand, bulk rosin prices were reduced $1.50/100 lb at the beginning of July. Seventy-percent pale material is now selling for $39.30/100 lb, f.o.b. southern producing points.

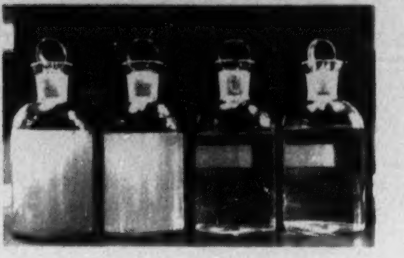
Soda ash: Decreased domestic demand for soda ash (Na_2CO_3), against a background of growing overcapacity, has resulted in two price decreases in 1982. At the end of June, natural trona prices decreased $2/ton to $90/ton, f.o.b. Green River. A similar decrease was instituted at the beginning of September, bringing the price of natural Na_2CO_3 tag to $88/ton. The $4/ton decrease was reportedly matched by Allied, the sole synthetic ash producer, bringing its f.o.b. Syracuse, N.Y., tag to $128/ton.

Wet-strength resins: The list price of most petrochemical feedstocks have been discounted substantially throughout most of 1982. However, the major raw materials for wet-strength resins—particularly polyamide-epichlorohydrin (PEC) and urea-formaldehyde (UF)—have continued to rise in price. PEC (12.5% solids) prices went up 8% on July 1, rising to $23.45/100 lb ($1.88/lb on a dry basis). UF prices had been boosted a month earlier (also by 8%), the 35%-solids grade going to $20/100 lb, while 25% UF was raised to $14.30/100 lb. In both cases, the dry-weight price is 57¢/lb. Melamine-formaldehyde (MF) wet-strength resin is currently selling for about $1/lb on a dry basis. A similar increase for wet-strength resins is expected for 1982. ☐

FIGURE 3: **Canadian price increases for 1982**



Shaded column shows price increases for first three months of 1982; unshaded data is for first seven months of this year.
Source: Statistics Canada, Industrial Prices Div.



Canadian survey

☐ Mill downtime has lowered demand for chemicals in 1982 across Canada. Chemical demand by the industry was also down in 1981, primarily because strikes idled almost 1,000,000 tons of pulp and papermaking capacity during the summer.

The results of the recession this year on price increases has been rather unusual. Although lists have gone up on some of the large-volume chemicals (see chemical profiles below), the year-to-year increase in the selling price index for industrial chemicals in July (see Figure 3) was only about 55% of that reported in 1981 (see PULP & PAPER, Nov. 1981, page 59).

Energy costs continued to rise (see Figure 3), although not as sharply as last year. Natural gas prices are expected to increase almost 20% during 1983 (mainly as a result of government surcharges).

Price discounting, while not as severe in Canada as it was in the U.S., is still occurring, with chlorine and caustic affected the most. Although paper industry demand for chloralkali is down significantly, actual production could be ahead of last year, since the leading producer is running its two plants full out as a result of a rationalization program with its U.S. parent. Nevertheless, prices for both caustic and chlorine have been discounted as much as 10%.

Consumption of bleaching chemicals dropped 6.4% in 1981 and at least a further 3.5% decrease is predicted for 1982.

Hydrogen peroxide is one of the very few chemicals that is expected to experience increased consumption by mills in 1982, despite the general industry downturn. Sparked by Ontario Paper Co. Ltd.'s expansion, demand by eastern Canadian mills should reach the 4000-ton mark this year.

By mid-decade, mills east of the Ontario/Manitoba border could account for more than 80% of the peroxide employed by the industry. The expected average annual growth to mid-decade of almost 17%—twice the average rate over the 1977-1979 period—may result in a domestic source of H_2O_2. The federal government recently approved the establishment of a joint-venture firm—between Solvay SA of Belgium and Laporte Industries of the United Kingdom—joint owners of Interox—which is planning to build a storage and distribution terminal in Milton, Ont., and, when justified by market growth, to produce the peroxide at a Quebec site to be determined at a later date.

DEFINITIONS OF SURVEY AVAILABILITY TERMS:

Very tight—On allocation or demand significantly greater than supply

Tight—Demand slightly greater than supply

Market—Supply and demand in balance, or excess capacity available

Aluminum sulfate

Uses: Alum usage is split approximately 50:50 between the precipitation of rosin size and pitch control/water treatment applications.

Demand: In 1981, paper mills consumed 105,000 tons, or 59% of total alum consumption. In 1982, total mill usage is expected to decrease to 98,000 tons (57% of total demand), of which about 48,500 tons will be employed for sizing. Total alum consumption in 1981 was 177,500 tons (the same as in the previous year) and in 1982 is predicted to drop to the 172,500-ton level. Municipal waste and sewage treatment applications now account for betwen 30% and 32% of the total, the balance going into pigments, cellulose insulation, and other miscellaneous end uses.

Sources: There are two major Canadian alum producers—Alcan Smelters & Chemicals and Allied Chemical Canada—and three smaller firms in western Canada, the largest (with two plants) being Inland Chemical, a CIL subsidiary.

Availability: 1982, market; 1981, market; 1980, market; 1979, market to tight.

Pricing: 1982, \$131.54/ton, liquid (17% Al_2O_3), bulk, f.o.b. Valleyfield, Que.; 1981, \$100.70-\$119.75/ton; 1980, \$86-\$100.70/ton; 1979, \$79-\$86/ton.

Forecast: The price of alum increased once in 1982, in January. No further increase is anticipated until next year, when mill demand should begin to increase. Average growth for total mill usage for the next three years is estimated at 7%/year.

Caustic soda

Uses: Caustic soda (NaOH) is used in the extraction stages of kraft or sulfite bleach plants, for hypochlorite makeup and in sulfite pulping.

Demand: In 1981, pulp mills consumed about 990,000 tons of caustic (62% of total domestic demand), with 714,000 tons used in the bleach plant. An additional 276,000 tons were employed for pulping applications. In 1982, demand decreased to 935,000 tons (694,000 tons for bleaching end uses). The next-largest end uses are in the production of propylene oxide and alumina, which last year accounted for 7% and 6% respectively of total demand.

Sources: Caustic is a coproduct of chlorine production. The major producers are listed in the chlorine section.

Availability: 1982, tight to market; 1981, very tight to tight; 1980, very tight; 1979, tight; 1978, tight.

Pricing: 1982, \$381-\$435.45*/ton, 50% solution, bulk, f.o.b. works, freight equalized; 1981, \$293-\$381/ton; 1980, \$195-\$293/ton; 1979, \$183-\$195/ton; 1978, \$175-\$183/ton. (* Effective April 1; no further hikes expected in 1982.)

Forecast: Caustic prices are now almost on a par with those for soda ash (based on Na_2O equivalent), which will likely result in some sulfite mills probably replacing caustic with soda ash even though caustic is available.

Overall caustic demand by the pulp and paper industry is expected to increase about 2%/year to mid-decade, although usage for sulfite pulping could drop below the 190,000-ton level by 1985—from the 245,000 tons predicted for 1982.

Chlorine

Uses: Chlorine's major use by the pulp and paper industry is as a bleaching agent in kraft and sulfite pulp mills. A smaller use is for on-site hypochlorite makeup.

Demand: In 1982, the pulp and paper industry used about 531,000 tons of chlorine, down about 7% from the 571,500 tons consumed in 1981. The industry share of total chlorine demand has decreased from 43% in 1980 to 39% in 1981. The rapid growth in ethylene dichloride (EDC) production has resulted in this market growing to 40% of total demand.

Sources: Chlorine is produced along with caustic by the electrolytic reduction of brine. Major chloralkali producers include CIL, Canadian Occidental Petroleum, Dow Chemical Canada, FMC Chemicals, and PPG Industries, Stanchem Div.

Availability: 1982, market; 1981, market; 1980, market; 1979, tight; 1978, tight.

Pricing: 1982, \$254-\$281*/ton, bulk, f.o.b. works; 1981, \$225-\$254/ton; 1980, \$195-\$255/ton; 1979, \$163-\$195/ton; 1978, \$145-\$165/ton. (* Effective April 1.)

Forecast: Pulp mill chlorine usage will decrease over the next few years as chlorine dioxide use grows. However, demand will not drop as rapidly as originally predicted. Most mills are only replacing between 6% to 8% of their first-stage chlorine requirements, rather than the originally proposed 30% to 70%. In fact, only one mill is at the theoretical maximum, while around four mills are currently operating on a greater-than-25% replacement basis. Moreover, in the near future—assuming that pulp markets begin their recovery next year—chlorine consumption by the mills should increase about 3%/year to mid-decade.

Hydrogen peroxide

Uses: The pulp and paper industry employs hydrogen peroxide (H_2O_2) as a bleaching agent for mechanical and chemical pulps. It is also used in the bleach plant as a partial replacement for ClO_2.

Demand: In 1981, Canadian mills used an estimated 5700 tons of H_2O_2, about 69% of total peroxide consumption. In 1982, mill usage is predicted to reach 7500 tons, 75% of total demand. Other end uses include textiles (9.5%), water treatment (5.5%), and miscellaneous applications (16%).

Sources: All of the peroxide consumed in Canada is imported. The major importers are CIL and duPont, which bring in H_2O_2 from FMC and E.I. duPont, respectively. FMC and Interox America ship in some on a direct basis, while several distributors handle European H_2O_2.

Availability: 1982, market; 1981, market; 1980, market to tight; 1979, market; 1978, market.

Pricing: 1982, 52.5¢/lb, bulk, 70% solution, f.o.b. Toronto; 1981, 47.5¢-52.5¢/lb; 1980, 44¢-47.5¢/lb; 1979, 41¢-44¢/lb; 1978, 36¢-41¢/lb.

Forecast: Hydrogen peroxide prices, unchanged since July 1981, should finally increase about 10% next year. By mid-decade, consumption by mills could reach the 11,500-ton level, almost 80% of total demand.

Hydrosulfites, borohydride solution

Uses: Almost all newsprint mills bleach groundwood with hydrosulfite. An alternative to purchased sodium hydrosulfite (either unblended or proprietary blends), Borol is employed by many mills to generate sodium hydrosulfite on-site.

Demand: In 1981, the pulp and paper industry used an estimated 10,200 tons of merchant sodium hydrosulfite, and an additional 8000 tons of Borol (on a 12% active borohydride basis). Vat dyeing of cotton accounted for about 12% of the total.

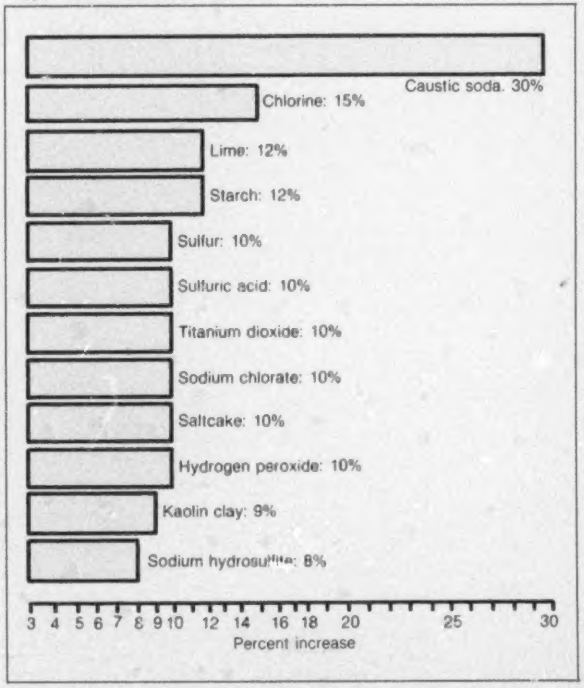
Sources: No hydrosulfite has been produced in Canada for several years. VirChem Canada imports blended hydrosulfites from its U.S. parent, Virginia Chemicals (a subsidiary of Celanese), while various distributors bring in product from Europe. Borol is shipped in exclusively by the Ventron Div. of Thiokol, which is merging with Morton-Norwich.

Availability: Hydrosulfite blends: 1982, market; 1981, market; 1980, market; 1979, market; 1978, market. Borol: 1982, market; 1981, market; 1980, market; 1979, market; 1978, market.

Pricing: Blended: 1982, 69¢-71¢/lb, delivered, eastern Canada: 1981, \$59¢-\$64/lb; 1980, 51.4¢/lb; 1979, 50.5¢/lb. Nonblended: 1982, 61¢-71.5¢/lb; 1981, 66.4¢-71.5¢/lb; 1980, 56¢-66.4¢/lb; 1979, 47.5¢-56¢/lb.

Forecast: The recent price boost of sodium hydro (to 71¢/lb) was actually an exchange adjustment and no further price hikes are expected until 1983. Mill downtime in 1982 will reduce hydrosulfite purchases by about 1000 tons. However, demand should pick up again and grow, on an average, 8%/year to mid-decade. Borol usage should increase about 9% in 1982. From 1981 to 1985 the annual growth in Borol demand should average 17%.

FIGURE 4: **Projected Canadian price increases for major chemicals in 1983**



Kaolin

Uses: Kaolin is used by paper and paperboard mills as a filler and as a coating pigment with coating applications accounting for 56% to 57%.

Demand: In 1981, coating applications consumed an estimated 127,000 tons of kaolin clay, while an additional 96,000 tons were used as filler, representing about 87% of total kaolin demand. The inventory buildup that began in 1979, when more than 300,000 tons were imported, has apparently eased, since imports have decreased since that time. In 1981, 255,500 tons were imported (280,500 in 1980). In 1982, consumption is expected to drop to 121,000 tons and 93,000 tons respectively for coating and filler end uses.

Sources: U.S. suppliers are listed in P&P *Buyers Guide 1982*, "Register of coating and filler pigments," pp. 32-38. The balance of the imports are from English China Clays of the U.K., imported by Somavac of Trois-Rivières, Que., which slurries the product for resale.

Availability: 1982, market; 1981, market; 1980, market; 1979, market to tight.

Pricing: Water-washed No. 1 coating grade: 1982, $218/ton, f.o.b. Ga.; 1981, $215-$218/ton; 1980, $208-$215/ton; 1979, $194-$208/ton. Dry-ground, air-floated filler grade: 1982, $60/ton (same basis); 1981, $47-$60/ton; 1980, $43-$47/ton; 1979, $35-$43/ton.

Forecast: Coating end use is expected to increase its share slightly (to 57%) to rise to between 144,000 and 145,000 tons out of a total mill consumption of 253,000 tons.

Lime

Uses: Kraft mills purchase lime to supply supplementary calcium requirements.

Demand: In 1981, pulp mills used 216,500 tons of lime (10.8%) out of a total consumption of slightly more than 2 million tons. In 1982, lime usage is expected to be down by 10,000 tons. The largest lime consumers are the iron and steel mills, which last year accounted for more than 700,000 tons (34% of the total). Other lime end uses, in descending order of volume, include: chemicals, uranium recovery, nonferrous smelters, water and sewage treatment, and sugar refining.

Sources: There are about nine merchant lime producers in Canada. The three major firms (based on nameplate capacity) are Domtar, Steel Brothers of Canada, and BeachviLime, which has a captive steel company customer as well (Dofasco). Algoma Steel and Steel Co. of Canada also have large captive operations. Because of high transportation costs (which continue to escalate), most lime plants are generally located within a reasonable distance of their customers.

Availability: 1982, market; 1981, market; 1980, market; 1979, tight to market; 1978, market.

Pricing: Quicklime: 1982, $55-$59/ton, bulk, f.o.b. producing plant; 1981, $46-$55/ton; 1980, $40.98-$46/ton; 1979, $34.98/ton; 1978, $32.48-$39/98/ton.

Forecast: The percentage of total lime consumption accounted for by the pulp and paper industry is declining with time, particularly as more mills opt for oxygen enrichment in the lime kiln. However, actual lime purchases by the mills should increase about 2%/year to mid-decade. Overall lime market growth has also been declining, rising less than 1% in 1981, compared with 1.5% in 1980 and 4%/year in the 1977-1979 period. Exports have also been dropping off, since the bulk of shipments to the U.S. have been to the steel industry.

Saltcake

Uses: Saltcake is used by kraft pulp mills for sodium and sulfur makeup.

Demand: In 1981, pulp mills used 318,500 tons, about 81% of total sulfate demand (394,000). The slump in the market pulp area will reduce mill consumption in 1982 to about 305,000 tons. The next-largest end use, the detergent industry, accounts for 13% of demand.

Sources: Most sodium sulfate comes from the Glauber salt deposits in Alberta and Saskatchewan with by-product sulfate capacity only 11% of the total. The major producers include Alberta Sulphate, Hudson's Bay Mining & Smelting's Francana Minerals Div., and Saskatchewan Minerals. The latter firm last year acquired the closed facility of Sybouts Sodium Sulfate and reopened it in May 1982. The two byproduct sulfate producers are Courtaulds and Ontario Paper, both in eastern Canada.

Availability: 1982, market; 1981, market; 1980, market; 1979, market; 1978, market.

Pricing: 1982, $70-$75*/ton, bulk, saltcake, f.o.b. producing point; 1981, $55-$70/ton; 1980, $50-$55/ton; 1979, $50/ton; 1978, $45-$50/ton. (* Effective April 1.)

Forecast: The price of saltcake has remained steady since the spring, and no further change is expected in 1982. If pulp markets improve significantly, a 10% price boost could occur next year in the second or third quarter. Over the long term, there will be more effluent recycling from ClO_2 generators, thus reducing the amount of purchased saltcake required.

Sodium chlorate

Uses: Sodium chlorate's main use is in chlorine dioxide generators.

Demand: In 1981, pulp mills used an estimated 197,000 tons of sodium chlorate, 95% of total chlorate consumption (206,500 tons). The slowdown in pulp markets will reduce mill demand to about 202,000 tons in 1982. Uranium leaching, the only other significant end-use for chlorate, should require about 11,000 tons in 1982.

Sources: The Canadian merchant producers of sodium chlorate are Canadian Occidental, Erco Industries, KemaNobel (formerly QueNord Chemicals), and PPG Industries, Stanchem Div. BCM Technologies is building a plant near Windsor, Que., due on-stream late this year or early 1983. The three remaining captive producers are B.C. Chemicals, St. Anne Chemical, and Saskatoon Chemicals; Canso Chemicals and Huron Chemicals having closed their plants late last year.

Availability: 1982, market; 1981, market; 1980, market; 1979, market; 1978, tight.

Pricing: 1982, $410*/ton, bulk, f.o.b. works, freight equalized; 1981, $365/ton; 1980, $310-$330/ton; 1979, $281-$310/ton; 1978, $250-$281/ton. (* PPG lists at $420/ton.)

Forecast: Pulp mill demand in 1982 is not expected to increase more than 5%, but chlorate consumption in that sector should grow about 8%/year to mid-decade. The two-tier list for sodium chlorate of $410-$420/ton should remain in force until at least year-end. In 1983, prices are expected to increase about 11%.

Starch

Uses: Most of the starch (80%) used is applied at the size press; some is employed with styrene-butadiene latex systems for coating. Wet end applications account for a relatively small quantity.

Demand: In 1981, the paper industry used an estimated 66,000 tons of starch, about 19% of total consumption, and this should increase about 1000 tons in 1982. The production of corn sweeteners accounted for about 54% of total demand in 1981. Other end uses include food starches, corrugated and other adhesives, ore flotation, and miscellaneous applications.

Sources: The bulk of the starch used by the paper industry is derived from corn. Major corn starch producers include Canada Starch, Nacan Products, St. Lawrence Starch, and Zymaize. International Grain Products is a smaller producer of corn starch and also supplies wheat starch.

Availability: Unmodified: 1982, market; 1981, market; 1980, market; 1979, market. Modified: 1982, market; 1981, market; 1980, market; 1979, market.

Pricing: 1982, native pearl (unmodified), $20.70/100 lb, truckload, bags, f.o.b. Toronto/Montreal; 1981, $19.20-$20.70/100 lb; 1980, $16.45-$19.20/100 lb; 1979, $14.45-$16.45/100 lb; 1978, $12.60-$14.59/100 lb. Modified starch prices vary according to grade, and generally follow the price trend for unmodified starches.

Forecast: With another record U.S. corn crop forecast for 1982, coupled with a drop off in Canadian demand, no price hikes are anticipated for the balance of 1982. A highly competitive marketplace has led to some discounting for larger-volume consumers. Annual growth in demand by the mills is expected to average about 4% to mid-decade.

Sulfur

Uses: Sulfite pulp mills that do not purchase liquid sulfur dioxide burn sulfur to produce gaseous SO_2 for sulfite and bisulfite cooking liquor makeup. ClO_2 generation and other uses in the bleach plant consume small amounts.

Demand: In 1981, an estimated 257,000 metric tons of sulfur were purchased by the Canadian pulp and paper industry, accounting for 30% of total consumption (about 853,000 metric tons). In 1982, the industry's usage is expected to decrease to about 235,000 tons, 28.5% of total demand. The largest end use for sulfur is sulfuric acid (63.5%), followed by carbon disulfide production, rubber vulcanization, and other miscellaneous applications.

Sources: All sulfur produced in Canada is recovered, either from sour-gas operations or petroleum refineries. Major producers include Amoco, Canadian Occidental, Canterra Energy (formerly Acquitaine Canada and Texasgulf), Chevron Standard, Dome Petroleum (formerly Hudson's Bay Oil & Gas), Petrogas Processing, Shell, and Westcoast Transmission.

Availability: 1982, market; 1981, tight to market; 1980, tight, 1979, tight.

Pricing: 1982, crushed, slate or molten, $75-$85/metric ton, f.o.b. producing point; 1981, $59.98-$74.48/ton; 1980, $32.76-$59.98/ton; 1979, $24.82-$29.79/ton. (Note: prices are in Canadian dollars.)

Forecast: Sulfur prices, which increased about 12% in 1982, should rise a similar amount during 1983. Sulfur consumption by the pulp and paper industry is on a downward trend, and by 1985, pulp mill usage will be less than 196,000 metric tons. (Prior to 1975, when sulfur usage began to decrease, the mills consumed upwards of 300,000 metric tpy.)

Sulfuric acid

Uses: The major use of sulfuric acid (H_2SO_4) is in the kraft pulp mill for chlorine dioxide generation.

Demand: In 1981, 268,000 tons of sulfuric acid were consumed by Canadian pulp mills out of a total of almost 4 million tons. The production of phosphoric acid is the major use and accounted for about 60% of the total in 1981. Pulp mill use in 1982 is expected to decrease to 241,000 tons. Other end uses include agricultural chemicals, petroleum refining, soaps and detergents, cellulose film, and viscose rayon.

Sources: Major merchant producers include Allied Chemical, Border Chemical, Cominco, Inco Metals, Inland Chemicals, and Kidd Creek Mines (formerly Texasgulf Canada). CIL, the largest acid supplier in North America, sold its Copper Cliff, Ont., operation to Inco in March 1981. In addition to the Inco-produced acid, CIL markets Kidd Creek's output as well as the acid not required captively by Falconbridge Nickel. Esso Chemical Canada and Western Cooperative Fertilizers are the major acid producers for captive purposes.

Availability: 1982, market; 1981, tight to market; 1980, market to tight; 1979, tight to market; 1978, very tight.

Pricing: 1982, 66° Baume, $84.55/ton, bulk, f.o.b. producing points, eastern Canada; 1981, $69.31-$84.55/ton; 1980, $60.87-$69/31/ton; 1979, $52.40-$60.87/ton.

Forecast: The 10% drop in pulp mill acid consumption in 1982 followed an 8.5% decrease in 1981 (largely due to the summer strike on the West Coast). However, mill demand is expected to increase, on an average, 6%/year to mid-decade. Prices went up twice in 1981, the second boost (of $6.76/ton) occurred in December. A 10% hike is likely in 1983.

Titanium dioxide

Uses: About 90% of the anatase TiO_2 used by the paper industry is employed for fine paper applications, with the balance used in paperboard.

Demand: Strikes at fine paper mills in the 1980-1981 period reduced TiO_2 demand for paper coating in 1981 to 7200 tons (from about 8200 tons in the previous year) out of a total titanium dioxide demand of 73,000 tons. In 1982, mill usage should reach 7700 tons. The paint industry accounts for between 58% to 59% to total usage, while plastics applications take about 16%.

Sources: There are two domestic producers—NL Chem Canada (formerly Canadian Titanium Pigments) and Tioxide of Canada, with a combined capacity of 79,000 tpy.

Availability: 1982, untreated anatase, market; 1981, market; 1980, market; 1979, market; 1978, market.

Pricing: 1982, $74.50-$80/100 lb, untreated anatase, delivered bags; 1981, $69-$74.50/100 lb; 1980, $59-$69/100 lb; 1979, $48.50-$59/100 lb. (Bulk slurry carries a 50¢/100 lb premium.)

Forecast: TiO_2 prices have not changed since January 18, 1982, and are expected to hold steady until year end. If demand improves in 1983, a 10% price hike is likely. Although total domestic demand is expected to grow at slightly less than 5%/year to mid-decade, mill usage should increase 11% to 12%/year to 1985. □

Silvichemical review: wood-based chemical production in U.S., Canada

Kraft mill byproducts have become increasingly important to the pulp and paper industry; production trends and values are detailed

By KENNETH E. SMITH, Executive Editor

☐ Numerous chemicals and other byproducts are derived from tree components and from spent pulping liquors. These byproducts, termed "silvichemicals," have become an increasingly profitable and diversified industry in recent years.

There are three primary sources of silvichemicals:

1. Sulfite and sulfate pulping processes
2. Pine stumps and pine tree tappings
3. Wood and bark.

Of these three, the chemical pulping processes provide the bulk of silvichemical products. During chemical pulping, 50% or more of the wood is dissolved by the inorganic cooking chemicals. The resulting complex mixture of lignosulfonate salts and wood sugars present in the waste or spent liquor is a rich source of chemical products. Pine stumps and pine tree tappings yield a group of byproducts termed "naval stores," which includes rosin, turpentine, and pine oils. Wood, woodchips, and bark can be distilled or extracted to produce a variety of specialty chemicals.

Silvichemical products can be classified under the following categories:

1. Tall oil products
2. Rosin products
3. Turpentine
4. Lignosulfonates
5. Wood and bark chemical products.

Tall oil and turpentine are the major byproducts of the sulfate (kraft) softwood pulping process. Rosin is distilled from pine tree tappings (gum rosin), from pine stumps (wood rosin), and from tall oil (tall oil rosin). Lignosulfonates, the metallic salts derived from the lignin in wood, were formerly produced only from spent sulfite liquor, but are now being made from sulfate black liquor as well. Wood and bark products range from charcoal to ethanol.

The three major product groups (naval stores, sulfate mill products, and sulfite mill products) shifted significantly in importance between 1963 and 1980. The combined annual value of sulfate mill products and sulfite mill products (at constant dollars) increased by 83% during this 17-year period, while the annual value of naval stores decreased by 55%. Actually, the decline in the annual value of naval stores has been even greater than this, since the second-largest revenue earner in that group, pine oil, is now made primarily from sulfate turpentine.

Tall oil products

Tall oil is present in the black liquor produced during sulfate (kraft) pulping of softwoods in the form of a crude soap. This soap, approximately 50% resin acids and fatty acids, is skimmed from the surface of the black liquor and boiled with sulfuric acid to remove the residual black liquor and sodium salts, as well as lignin and other impurities.

The crude tall oil thus recovered is about 95% rosin and fatty acids and 5% sterols, alcohols, and other materials. The rosin and fatty acids may then be separated through fractionation; or the crude tall oil may be acid-refined, which improves the color and odor but does not separate the components.

Production of crude tall oil increased at an average annual rate of 4.3% between 1963-1981, reaching 1761 million lb, or 880,500 short tons, in 1981. Production of sulfate pulp increased at an annual rate of 9.5% during the same period. The difference between the increase in tall oil production compared with the increase of sulfate pulp production reflects several factors in the industry including: increased pulping of hardwood; increased use of sawmill residuals and byproduct chips; use of continuous rather than batch digesters; and increased cutting of younger, plantation-grown pine trees.

Improved recovery techniques and increased sulfate pulping of extractive-rich Southern pines have begun to reverse the decline in tall oil yields, however. In 1980, about 76% of the U.S. softwood sulfate paper-grade pulp capacity (30.7 million tpy) was based in the South. Between 1975 and 1981, production of crude tall oil rose at an average annual rate of 7.2%, from 1228 million lb in 1975 to 1761 million lb in 1981.

Trends in the production of the three major tall oil fractions (rosin, fatty acids, and distilled tall oil, including acid-refined tall oil) are shown in Table 1. Tall oil fatty acids (TOFA) in recent years have experienced the greatest revenue increase of the three fractions. In 1980, they had an annual wholesale value of $102 million f.o.b. mill, or about $6 million less than the annual value of tall oil rosin that year. In 1961, the annual value of tall oil rosin production was twice that of TOFA.

Currently, the major tall oil fractionators in the U.S. are Arizona Chemicals, Hercules Inc., Union Camp Corp., Reichhold Chemicals Inc., Sylvachem Corp., Westvaco Corp., Monsanto-Emery, and Georgia-Pacific Corp. During the late 1950s and early 1960s, surface coatings were the largest single end use for domestic tall oil fatty acids. However, as the following breakdown shows, intermediate chemicals now account for about half the total U.S. TOFA consumption:

Major uses of tall oil fatty acids in U.S.
(% of total consumption)

Use	**1971**	**1980**
Intermediate chemicals	36.8	49.1
Protective coatings	30.0	21.2
Soaps and detergents	13.3	7.1
Ore flotation	6.1	3.7
Miscellaneous	13.8	18.9

Source: Pulp Chemicals Assn.

TABLE 1: **Production of crude tall oil and tall oil fractions in U.S., 1963-1981**

(million lb)

Year	**Crude tall oil***	**Tall oil rosin**	**Tall oil fatty acids****	**Distilled tall oil***
1963	990	275	239	82
1964	1104	305	264	81
1965	1145	326	298	84
1966	1242	364	337	108
1967	1211	354	333	104
1968	1239	371	339	99
1969	1284	412	371	98
1970	1252	416	400	99
1971	1268	419	407	92
1972	1293	437	429	92
1973	1329	443	412	82
1974	1213	366	363	82
1975	1228	342	293	75
1976	1484	410	374	85
1977	1518	406	359	103
1978	1616	424	388	115
1979	1697	464	416	113
1980	1754	448	407	103
1981	1761	444	407	109

*Source: Pulp chemicals Assn; distilled tall oil data include acid-refined tall oil
**Source: Chemical Economic Handbook, SRI International

TABLE 2: **Production of rosin in U.S., 1963-1981**

(million lb)

Year	**Gum rosin**	**Steam-distilled wood rosin**	**Tall oil rosin**	**Total rosin**
1963	239	571	275	1085
1964	203	539	305	1047
1965	187	561	326	1074
1966	141	513	364	1018
1967	116	502	354	972
1968	88	499	371	958
1969	61	432	412	905
1970	45	400	416	861
1971	48	381	419	848
1972	46	364	437	847
1973	39	342	443	824
1974	28	284	366	678
1975	37	186	342	565
1976	31	265	410	706
1977	26	251	406	678
1978	18	240	422	682
1979	14	232	464	710
1980	12	230^e	418	660
1981	10	230^e	450	690

Sources: Crop reporting board, USDA, Pulp Chemicals Assn. Production data for gum rosin and steam-distilled wood rosin refer to crop year, April 1 to March 31.
e = estimated.

Dimer acids used in polyamide resins for ink, adhesive, and special coating applications are the most important intermediate chemicals, accounting for nearly two-thirds of the TOFA consumption in this category. Other chemicals under this heading are:

- Epoxidized esters used as a plasticizer/stabilizer system for PVC resins
- C-21 diacid surfactants made by reacting acrylic acid with the linoleic content of TOFA and then removing the unreacted oleic acid.
- Oleic, linoleic, and conjugated linoleic acids produced from low-rosin TOFA via solvent crystallization and subsequent treatment
- TOFA amido amines for flotation.

Rosin

Gum and wood rosin (naval stores rosin) are distilled from pine oleoresin—gum rosin from the sap of living trees, and wood rosin from the oleoresin extracted from dead stumps with solvents, then steam-distilled. Tall oil rosin is fractionated from crude tall oil.

The gum rosin and turpentine industry in the U.S. has practically vanished. The remaining activity is almost entirely in south Georgia. The U.S. is a net importer of both gum rosin and gum turpentine. Gross imports of gum turpentine during the April 1980-March 1981 crop season totaled 534,500 gal, a 49% increase from the previous season. Gross imports of gum rosin during the same period totaled 14.7 million lb, down 30% from the previous season. In 1980, the total market value of U.S.-produced gum rosin and gum turpentine was only about $5 million.

Only two U.S. companies, Hercules and Reichhold, still manufacture steam-distilled wood rosin and turpentine. The wood rosin business in the U.S. is based on the extraction of rosin and terpenes from aged pine stumps which are primarily from cuttings of virgin forests in the Southeast. Aged pine stumps are required because they are high (20% to 25%) in extractable material. In recent years, these aged stumps have become more scarce, hence the decline in the wood naval stores industry.

Hercules recently has begun treating the root collars of relatively young trees with "Pinex" reagent (probably a herbicide such as Paraquat) prior to harvesting. Studies have shown that the extractives content of pine stumps cut two years after the treatment is significantly higher than untreated trees. Commerical application of the Pinex program was begun in the fall of 1979, and the first stumps will be harvested and processed in 1982.

The output of tall oil rosin exceeded that of naval stores rosin for the first time in 1972, and reached a level of 444 million lb (222,000 short tons) in 1981 (see Table 2). Between 1963 and 1981, the share of tall oil rosin in total U.S. rosin production increased from 25% to 65%. Tall oil will probably account for nearly 90% of all rosin output by 1990 unless the Pinex process causes a major resurgence in the wood rosin industry.

Rosin consumption in the U.S. declined an average of 3%/year between 1970 and 1980. Total U.S. consumption in 1970 was 760 million lb, compared with 554 million lb in 1980. Significant decreases in rosin used for sizing paper and in rubber for tires have led to this decline. Exports have also declined, by 3.9%/year, from 256 million lb in 1970 to 179 million lb in 1980.

The following table is a breakdown of major uses:

Major uses of rosin in U.S.
(% of total)

Use	**1977**	**1980**
Rubber and chemicals	35.2	33.2
Paper sizing	33.5	33.1
Ester gums, synthetic resins	22.7	25.2
Paints, varnishes, lacquers	2.2	2.0
Other uses	6.7	6.5

Source: Pulp Chemicals Assn.

Printing inks appear to be the major potential growth area for increased rosin use, in the form of variously modified rosin esters and in resinates.

Sulfate turpentine

While total turpentine production in the U.S. declined 22% between 1963 and 1981, the production of sulfate turpentine increased 24% in that period, and in 1981 accounted for 89% of U.S. turpentine production (Table 3).

Sulfate turpentine is recovered from the condensate of kraft softwood digester relief gases. Gum and wood turpentine are distilled in the same manner as naval stores rosin, turpentine being the volatile part of the gum, and rosin the nonvolatile residue. Since 1963, the major use for turpentine has changed from its traditional one as a solvent for oil-base paints, to its primary use as a raw material in the production of various chemicals. Major uses of turpentine in the U.S. are indicated below, expressed as percent of total turpentine output in 1981:

Major uses of turpentine in U.S.
(% of total)

Use	**1981**
Synthesis of pine oil	48
Manufacture of terpene resins	16
Chlorinated terpene insecticides	15
Flavors and fragrances	10
Other	11

The major use of turpentine is currently in the synthesis of pine oil. More than 80% of the pine oil produced today is synthetic. The rest is "natural pine oil" obtained from fractionation of pine stumpwood extractives.

The increased demand for turpentine resulting from the development of new uses has made for a steady increase in price, further aggravated by a decrease in supply. Table 4 summarizes U.S. naval stores and sulfate mill silvichemicals production between 1978-81.

Canadian naval stores

Canada is a relatively small producer of naval stores at present. In 1980, Canadian crude tall oil (CTO) production totalled 84,000 tons, and Canadian sulfate turpentine production was 3.2 million gal.

There are two distinct geographical regions in Canada producing naval stores: Western Canada, consisting of interior kraft mills in British Columbia and Alberta; and Eastern Canada, particularly mills in the lakehead region of Ontario. Of the 12 mills in the western area with sulfate soap collection potential, only eight were collecting soap in 1980, and only two were producing CTO. In Eastern Canada, eight of nine mills with collection po-

TABLE 3: **Production of turpentine in U.S., 1963-1981**

(million gal)

Year	**Gum**	**Steam-distilled wood**	**Sulfate***	**Total**
1963	7.03	7.87	18.78	33.7
1964	5.98	7.87	20.02	33.9
1965	5.57	8.43	21.03	35.0
1966	4.21	7.73	21.34	33.3
1967	3.39	7.02	20.99	31.4
1968	2.52	6.43	23.66	32.6
1969	1.75	5.14	23.98	30.9
1970	1.29	4.73	22.77	28.8
1971	1.42	4.27	22.75	28.4
1972	1.33	3.77	23.21	28.3
1973	1.07	3.44	22.02	26.5
1974	0.78	3.11	20.46	24.4
1975	1.03	2.07	19.27	22.4
1976	0.87	2.99	20.26	24.1
1977	0.73	2.62	20.30	23.6
1978	0.52	2.37	22.07	25.0
1979	0.37	2.44	23.45	26.3
1980	0.34	2.61	24.98	27.9
1981	0.31	2.61^e	23.31	26.2

*Data refer to refined sulfate turpentine, derived from crude turpentine data by multiplying by 0.8
Sources: Crop Reporting Board, USDA, Pulp Chemicals Assn. Naval Stores Review, 1974 Yearbook
e = estimated

TABLE 4: **U.S. silvichemical production, 1979-1981**

(millions of units)

	Unit	**1978**	**1981**
Naval stores			
Gum rosin	lb	18	10
Steam-distilled rosin	lb	240	230
Gum turpentine	gal	0.52	0.31
Steam-distilled turpentine	gal	2.37	2.61
Sulfate mill products			
Crude tall oil	lb	1616	1761
Crude tall oil, used as such or sold	lb	138	160
Distilled tall oil[1]	lb	115	109
Tall oil rosin	lb	422	444
Tall oil fatty acids	lb	388	407
Sulfate turpentine	gal	22.07	23.31

1. Includes acid-refined tall oil
Source: Pulp Chemicals Assn.

tential are collecting soap, and five are producing CTO.

CTO recovery in 1980 averaged 44 lb/a.d. ton of pulp production at eastern mills and 35 lb/a.d. ton at western mills. The average CTO acid number is the east was 142, and the average in the west was 136. (Note: CTO acid number at mills in the U.S. South averages about 160.) The difference in CTO yield and quality between the two regions can be attributed to the varying species being pulped. Spruce is widely pulped in the west with pine, and gives very low CTO yields and quality (20 to 30 lb/a.d. ton yield, 143 calculated acid number). Also, sawmill chips are extensively pulped in the west, which leads to reduced byproducts yield.

Between 1979 and 1980, Canadian CTO production totals increased by nearly 13%. According to recent estimates, if all mills pulping soap-bearing woodchips were to implement soap collection at the present efficiency (estimated at 40%), CTO production would rise to 96,000 tpy by 1985. If soap collection efficiency were improved to an attainable 80%, CTO production could potentially reach 191,000 tpy. Thus, Canada remains the largest untapped source of tall oil in the western world.

Canada has only one operating CTO fractionation plant, a 19,000-tpy plant in Burlington, Ont., owned by Hercules Canada. In 1977, Canada exported 3700 tons of CTO to Japan and 37,000 tons to fractionation plants in the U.S. Exports increased in 1980 to 8300 tons to Japan and 41,900 tons to the U.S. Additionally, 30,700 tons of soap were shipped to the U.S. in 1980.

Soap shipments have since been discontinued because of prohibitively high transportation costs. Because Canadian CTO production exceeds domestic fractionation capacity by about 66,000 tpy, several companies have discussed building additional fractionation capacity there. However, it is likely that Canada will remain a net exporter of tall oil and an importer of refined tall oil products for several years.

In Western Canada, 12 of 20 kraft mills with sulfate turpentine collection potential have collecting equipment in place, but only eight of those mills are actively collecting turpentine.

In the east, eight of nine mills with collection potential are actively collecting turpentine. Turpentine yield in the east averaged 1.2 gal/a.d. ton in 1980, while average yield in the west was only 0.1 gal/a.d. ton. The low yield in the west is due to the predominant use of continuous digesters and sawmill chips for pulping.

The alpha-pinene and beta-pinene contents of the western turpentine from western interior mills is high in beta-phellandrene, a compound used to impart the menthol flavor to cigarettes. If an economical means were found to separate and recover this compound, western turpentine recovery efforts would probably be greatly increased. Also, it is estimated that if all Canadian mills pulping turpentine-bearing species and having turpentine collecton equipment were to collect turpentine, production would be increased to 4.1 million gal.

Other sulfate mill products

Dimethyl sulfide is produced by treating black liquor with sulfur at high temperature and pressure. Crown Zellerbach Corp. is currently producing about 20 million lb/year of dimethyl sulfide at its Bogalusa, La., mill. Some of the dimethyl sulfide is oxidized to dimethyl sulfoxide (DMSO), which has shown great promise as an industrial solvent and for some medical preparations, since it can diffuse through human or animal skin with ease. Initial restrictions on its use imposed by the Food & Drug Administration have now been removed. Expansion of existing plant capacity may, however, be stifled by the fact that dimethyl sulfide can easily be made by the petrochemical industry from methanol and hydrogen sulfide.

Westvaco produces **alkali lignin** ("sulfate lignin") at its North Charleston, S.C., mill by acidification of kraft black liquor. Sulfonation of this lignin yields a series of **lignosulfonates**. While these alkali-lignin-derived lignosulfonates make up only a small percentage of total lignosulfonate production, they have shown themselves to be very competitive with lignosulfonates from sulfite mills, since the degree of sulfonation of the alkali lignin can be selected to fit the end use.

These specialty compounds are used as dispersants, wetting agents, grinding aids, emulsifiers, coemulsifiers, stabilizers, antistripping agents, spray tank adjuvants, detergents, frothing aids, resin coreactants, sequestrants, air-entraining agents, retarders, fiber processing aids, leveling agents, hydrotropes, and other intermediates. Output of alkali lignin in 1980 was estimated at 60 million lb, with a value of about $8 million.

The total annual value of sulfate mill products in 1980 was estimated at $326 million, or slightly more than half of the annual value of byproducts produced by the three major groups in the U.S. that year (see Table 5). These figures are somewhat misleading, since pine oil made from sulfate turpentine is included in the naval stores category.

Lignosulfonates

Lignosulfonates are the main chemical byproduct of the sulfite pulping process. In 1980, the U.S. production of lignosulfonates amounted to 881 million lb, with a total value of $63.8 million. However, some of these lignosulfonates were made from sulfate lignin, as explained above. The average 1980 value for lignosulfonate production was $140/ton, which includes unmodified, low-profit commodity grades of whole spent sulfite liquor evaporated to 50% to 95% solids and sold mainly as binders for applications such as animal feed pellet manufacture, zinc production, and concrete mixing.

The uses of lignosulfonate specialty products cover a wide range, including emulsification, deflocculation, chelation, and adsorption. Probably the best prospects for growth (about 10%/year) in this area are oil-field chemicals, which are largely Na-based specialties. Lignosulfate mud thinners and dispersants are widely used in deep oilwell drilling, and currently sell for around $300/ton.

Normally, only sulfite mills using ammonia or calcium bases produce lignosulfonates because magnesium and sodium-base mills find it more economical to recover spent liquors. In the U.S., American Can Co., Crown Zellerbach Corp., Consolidated Papers Inc., Flambeau Paper Corp., Georgia-Pacific Corp., ITT Rayonier Inc., and Rhinelander Paper Co. are producers of specialty lignosulfonates. Crown Zellerbach has recently licensed its lignosulfonate line to ITT Rayonier, which will produce the chemicals at Hoquiam, Wash. Crown Zellerbach will phase out lignosulfonate production at its Lebanon, Ore., mill.

In Canada, Reed Paper Ltd. is the sole producer of specialty chemicals at its subsidiary, Lignosol Chemicals, in Quebec City, Que. The capacity of the Lignosol plant is currently being expanded from 110 to 240 million lb/year.

Other sulfite mill products

Vanillin is formed by the alkaline oxidation of lignosulfonates in desugared spent sulfite liquor. Production and sales of vanillin have increased faster than those of any other silvichemical in the U.S. during the past 17 years. The market for vanillin is expanding, not only for use as a fragrance and flavoring agent, but also as a valuable raw material for the chemical and pharmaceutical industries. Vanillin is currently the preferred raw material for the manufacture of l-dopa, a drug widely used in treating Parkinson's disease.

Monsanto's mill at Seattle, Wash., is producing about 15 million lb/year of vanillin, valued at $71 million, f.o.b. mill, using only a fraction of the spent pulping liquor produced at Georgia-Pacific's mill at Bellingham, Wash. ITT Rayonier brought a vanillin plant on-stream in 1979 at Hoquiam, Wash., with an initial capacity of 2 million lb/year.

In Canada, Ontario Paper Co. is producing 7 million lb/year of vanillin at its 240-tpd, Na-based sulfite mill in Thorold, Ont. As byproducts of this operation, the mill also produces aceto vanillone, vanillil, and oxalic acid.

Torula yeast (*Torulopis utilis* or *Candida utilis*) is grown in the pentose and hexose sugars present in spent sulfite liquor. This pleasant-tasting food yeast can average over 50% protein, and contains B-complex vitamins and all essential amino acids and numerous minerals necessary to good nutrition. It is used as a food additive to boost nutritional value and flavor and as a substitute for more expensive protein sources.

Production of torula yeast reached a peak of about 18 million lb/year in 1980. The product was priced at approximately $0.50/lb, f.o.b. mill, and annual sales revenue was about $75/ton of sulfite pulp from an average dry yeast yield of 150 lb/ton of pulp. At that time, two mills in the U.S., Rhinelander Paper, Rhinelander, Wis., and Boise Cascade, Salem, Ore., were producing the yeast. However, the Boise mill was closed in June 1982, leaving the Rhinelander mill as the sole U.S. producer of yeast from sulfite liquor, with a capacity of about 8 million lb/year.

Ethyl alcohol, or ethanol, is obtained by fermenting the sugars in spent sulfite liquor. Only one company in the U.S. (Georgia-Pacific) is currently making ethanol; the Bellingham, Wash., mill yields approximately 5.5 million gal/year of 190-proof alcohol, representing about 25 gal/ton of sulfite pulp. This alcohol is competitive in both quality and price with alcohol made from ethylene. Since there are presently nine sulfite mills of similar capacity to the Bellingham mill operating in the U.S., they could together produce some 50 million gal/year of 190-proof alcohol if they followed the example of Georgia-Pacific.

Ontario Paper Co., Thorold, Ont., is currently producing one million gal/year of ethanol from sulfite liquor, and is the only such producer in Canada.

Sonoco Products Co. is producing **acetic acid** at its NSSC pulp mill at Hartsville, S.C., by extracting the acidified spent pulping liquor with methyl ethyl ketone (MEK), which is then removed by distillation and recycled. Actually, both acetic and **formic acid** are obtained in this manner, but the latter is extracted with ethylene dichloride (EDC). Eight million lb of glacial acetic acid, worth about $1.9 million, are recovered annually. Formic acid is not sold at present.

The annual value of silvichemicals produced from spent sulfite liquors in the U.S. in 1980 is estimated at $166 million, or about 27% of the annual value of total U.S. production that year. This value may be low since it is based on unmodified lignosulfonates. ☐

TABLE 5: **Production and value of byproduct chemicals in U.S., 1980**

Product	**Unit**	**Production** (millions of units)	**Average price**[7] ($/unit)	**Annual value** ($ million)
Naval stores[1]				
Gum rosin	lb	12	0.35	4.2
Steam-distilled rosin	lb	230	0.30	69.0
Gum turpentine	gal	0.34	2.04	0.7
Steam-distilled turpentine	gal	2.61	1.80	4.7
Pine oil[6]	gal	9.64	3.80	36.6
Other turpenes	gal	2.95	1.80	5.3
Subtotal				120.5
Sulfate mill products:				
Crude tall oil	lb	1761	0.10	—[2]
Crude tall oil, used as such or sold	lb	118	0.10	11.8
Distilled tall oil[3]	lb	109	0.24	26.2
Tall oil rosin	lb	448	0.24	107.5
Tall oil fatty acids	lb	407	0.25	101.8
Sulfate turpentine	gal	24.98	1.45	36.2
Pitch	lb	580[5]	0.05[5]	29.0
Sulfate lignin	lb	60[5]	0.07[5]	8.4
Dimethyl sulfide	lb	18	0.37	4.2
Dimethyl sulfoxide	lb	2[5]	0.60[5]	1.2
Subtotal				326.3
Sulfite mill products:				
Lignosulfonate, Ca-base	lb	625	0.04	25.3
Lignosulfonate, Na-base	lb	99	0.17	16.9
Lignosulfonate, other[4]	lb	156	0.14	21.5
Lignosulfonate, total	lb	881	0.07	—[2]
Ethanol, 190-proof	gal	5.5	1.83	10.1
Vanillin	lb	17	4.75	80.8
Torula food yeast, dry	lb	18	0.50	9.0
Acetic acid, glacial[8]	lb	8	0.24	1.9
Subtotal				165.6
Total all categories				**612.4**

1. Naval stores data are for crop year, April 1 to March 3
2. Value accounted for under other headings
3. Includes acid-refined tall oil
4. Includes lignosulfonates from sulfate lignin
5. Estimated
6. Includes pine oil made from sulfate turpentine
7. Carload or wholesale price, f.o.b. mill
8. Made from NSSC spent pulping liquor

Industry makes significant gains in energy use during past 10 years

Fossil fuel, purchased power consumption per unit of output declined by more than 30% from 1972-81, but cost as percent of sales price doubled

By JOHN C.W. EVANS, Senior Editor

☐ During 1972-81, the pulp and paper industry achieved a 30.7% reduction in fossil fuel and purchased energy usage per ton of output compared with ten years earlier (Figure 1A), according to a report issued recently by the American Paper Institute. In "Patterns of fuel and energy consumption in the U.S. pulp and paper industry, 1972-1981," API explained that the 30% reduction was adjusted from the actual reported improvement of 24.9% to reflect operating changes between 1972-81 that affect efficiency (for example, capacity utilization rate, fuel mix, and energy used for environmental control).

Other major achievements in power usage and purchased fossil fuel and energy during this particular period include:

- Increased use of residue sources of fuel (spent pulping liquors, hogged wastewood, bark) and self-generated hydroelectric power was equivalent to 36 million bbl of oil (which equals about nine days of current U.S. oil imports).
- The industry's total oil consumption was down 43%, while purchased fossil fuels and energy fell nearly 15%. In the same period, output of pulp, paper, and paperboard increased more than 17%.

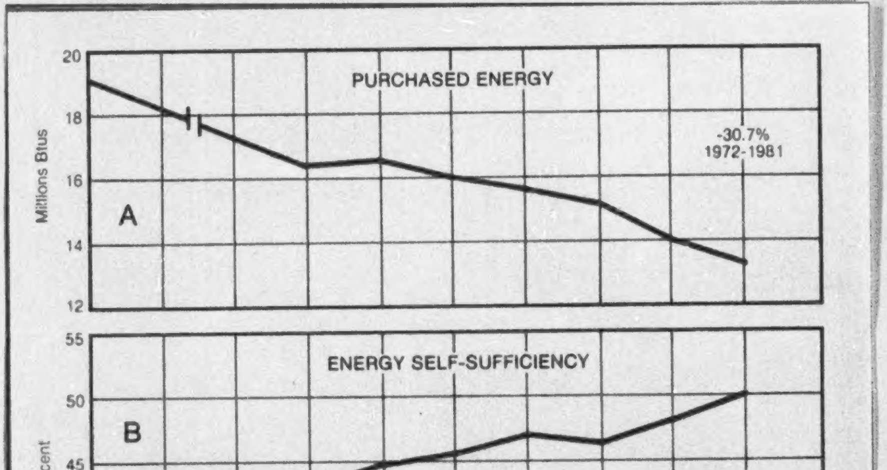
Hereby, the industry exceeded the Federal Energy Agency goal of a 23% reduction in the adjusted use of fossil fuel and purchased energy per ton of production.

According to the latest information (U.S. Dept. of Commerce, 1979), the U.S. pulp, paper, and paperboard industry is the third-largest user of fuel and energy of U.S. manufacturing industries, using 32% of all fuel oils and 6.8% of natural gas consumed in 1979. The paper industry was third in use of coal and purchased power.

The API report points out that the paper industry is the leading U.S. industry in producing electric power for its own use, including generating power from high-pressure steam and using resultant turbine low-pressure steam output as process steam (cogeneration). Some 37% of the industry's electricity is cogenerated (Figure 1B). According to the report, this is equivalent to more than five days of U.S. total oil imports at current rates.

Trends in consumption per ton of fossil fuel and power per ton of pulp, paper, and paperboard produced have de-

FIGURE 1A: **Fossil fuel and purchased energy consumption (adjusted)/ton**
FIGURE 1B: **Growth in paper industry's self-sufficiency as percent of total**



clined 25% since 1972 (Figure 2) despite a drop in capacity utilization in 1981 and increased energy use for lowering emissions. Thus, while increased production and prices gave a triple increase in total shipment value, purchased fuel and power costs were up sixfold. The cost of purchased fuel and power doubled in ten years, relative to the industry's average unit sales price, and cost per ton of product has risen due to their higher purchase price.

Fuel and energy sources

Consumption of 66.4 million tons of spent pulping liquor solids accounted for 37.6% of the total energy use by the industry in 1981, compared with consumption of 56.4 million tons of solids, or 33.6%, in 1972 (Figure 3).

Use of wood residues and bark as boiler fuel has increased from 6.6% of the paper industry's total energy consumption in 1972, to almost 12% in 1981. More than 30 million tons of wood residues and bark were consumed in 1981, compared with about 16 million tons in 1972.

Coal use has been almost level since 1972. An absolute decline occurred in the earlier part of the 1972-81 period, and slight increase was reported for 1980 and 1981. However, coal-fired boilers made up 24.0% of the total new boiler capacity sold to the paper industry in 1980, and 42% in 1981.

Use of natural gas and oil both decreased significantly from 1972 through 1974, with forced reduction in gas use due to the interruptible nature of supplies to industrial consumers, and allocations by suppliers to higher-priority end-users. Natural gas usage continued to decline through 1978, while oil rose in absolute terms. In 1978, with the Iranian crisis, the industry reversed its relative usage of gas and oil.

Use of purchased electricity increased slowly but significantly between 1972-81, from more than 27 billion kwh in 1972 to more than 41 billion kwh in 1981.

Boiler sales to the industry

Boiler sales to the pulp and paper industry for 1972-81 are discussed in the report's appendix. This study shows that although the number and capacity of boilers sold to the industry between 1972 and 1979 declined, sales in 1980 and 1981 increased over the 1979 levels.

The report shows that, in general, purchases of non-oil- and non-gas-burning boilers have increased dramatically since 1972 (Figure 4). Boilers based on these fuels represented 82% of sales of boiler capacity to the industry in 1972, and 59% of total sales in 1973. Purchases of non-oil- and non-gas-burning boilers increased to 96% of the total in 1980, before declining to 82% of the total in 1981. Although the largest increase in total capacity sales to the paper industry in recent years was reported in wood- and bark-burning boilers (which increased from 8% of the 1972 total to 48% of the 1979 total), they declined to 38% of total capacity in 1980, and 19% in 1981.

Sales of coal-burning boilers increased significantly in 1980, accounting for 24% of total capacity sales, the largest percentage of coal-burning boiler capacity sales in the ten-year study. The relative decline since 1979 in orders for black liquor and bark/woodwaste boilers (Figure 4) reflects the fact that many pulp-producing mills had already expanded capacity relative to the availability of these fuel sources. To order copies of this API report, see the Bookshelf section of this issue (p. 179). ☐

FIGURE 2: **Energy use per unit of output in million Btu/ton**

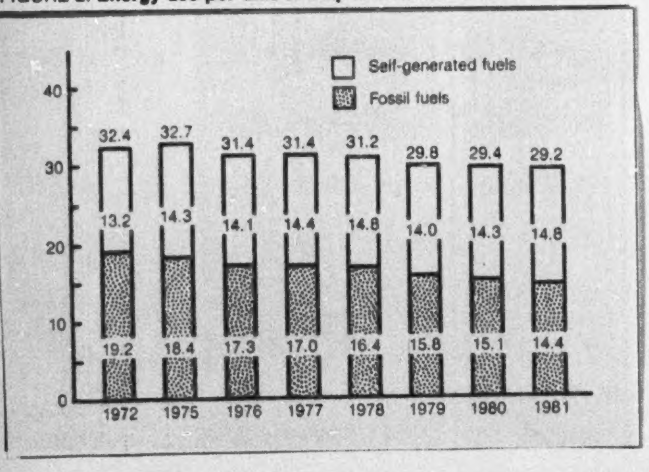


FIGURE 3: **Changes in the types of fuel used in boilers**

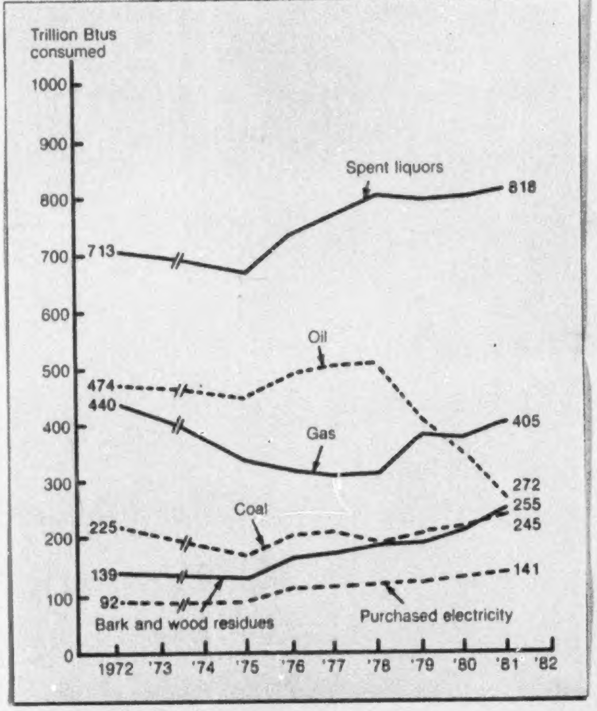
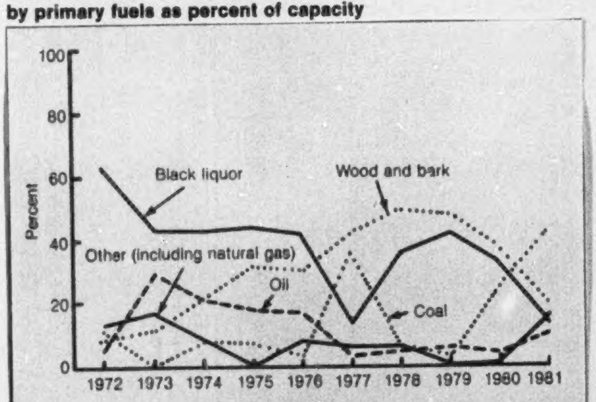


FIGURE 4: **New boiler purchases by primary fuels as percent of capacity**



Source: American Boiler Manufactures Assn.

Composting offers alternative for effluent plant sludge disposal

Disposing of sludge by composting is found to be economical, environmentally sound, and to produce a valuable byproduct from waste

By JOEL E. ALPERT, ELIOT EPSTEIN and CAROL DE GROOT

☐ Composting, the microbial degradation of organic material, is familiar to many people as a relatively simple means of converting garden debris and food scraps into a rich organic humus. In recent years, this same process has received increasing attention as a method for transforming municipal sludge to agricultural and landscaping use. In particular, many municipalities have adopted composting as a cost-effective and environmentally sound method for sewage sludge disposal. The EPA is actively encouraging development and implementation of composting systems, and several states are following suit.

Composting of both municipal and industrial organic wastes offers several advantages over other disposal methods:

- It converts a waste into a valuable material that can be marketed and used in a variety of applications.
- The process requires little capital investment, and is extremely flexible in the labor-to-capital ratio.
- The operation can be rapidly implemented.
- The process uses little energy.

Pulp and paper mill sludges, in particular, have proven highly suitable for rapid biodegradation through composting. These wastes have traditionally been deposited in landfills or incinerated, but environmental regulations and economic considerations have led many mills to seek alternative disposal methods. Studies by E&A Environmental Consultants have shown a broad range of pulp and paper mill sludges to be excellent candidates for composting. In general, sludges should have the following characteristics: dewatered primary and secondary sludges, or a mixture of both; volatile solids of 40% to 60%; ash content of 35% to 50%, and pH of 5.5 to 9.5.

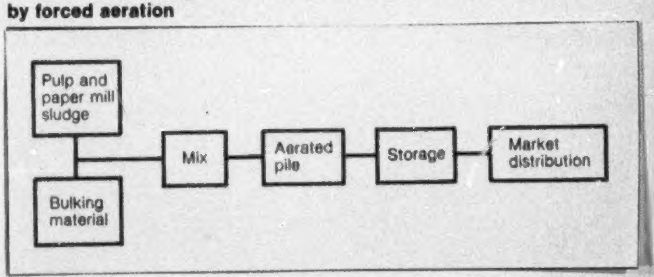
The heavy metals content of the sludge will not affect the process. However, if the resulting compost contains high levels of heavy metals, it may have to be restricted to nonagricultural uses in order to comply with EPA regulations. This requirement should not affect product marketability, since compost is usually distributed to nonagricultural users. If a sludge contains toxic organics, many of these compounds will be degraded during composting to produce an environmentally acceptable product. The presence of calcium, clay, phosphorus or lime in a sludge may actually enhance the product's value.

Process description

In 1974, the U.S. Dept. of Agriculture developed an improved method of composting. Known as the forced-aeration or "Beltsville" method, the process works by mechanically drawing air through the pile of composting material. The fan used in the process may be reversed to blow air through the pile once pathogen (disease microorganism) destruction is achieved. This method of aeration ensures more reliable, more uniform composting than the traditional "garden variety," or windrow, method in which the compost piles are turned over several times for aeration. The forced-aeration method has proven highly effective on pulp and paper mill sludges.

Figure 1 illustrates the process flow. Sludge is mixed with a bulking agent to the correct ratio. The purpose of the bulking agent is to provide uniform porosity so that air may be drawn or blown through the entire composting pile, and to lower the moisture content of the sludge. The bulking agent may be a variety of materials. Generally, the most available and useful agents are bark and

FIGURE 1: **Flow diagram for composting pulp and paper mill sludge by forced aeration**



Dr. Alpert and Dr. Epstein are chief environmental scientists, and Ms. de Groot is a scientist at E&A Environmental Consultants, Stoughton, Mass.

woodchips. Mixing can be achieved by several types of equipment, depending on the quantity of sludge to be handled. Following mixing, the combined sludge-bulking agent material is gathered and placed in an aerated pile.

Figure 2 is a schematic of a forced aeration composting system. The basic steps in constructing a pile are:

1. A loop of perforated 4-in. plastic drainage pipe is laid on the site surface. The configuration will depend on the amount of sludge to be handled daily.
2. The pipe is covered with 8 in. to 12 in. of bark, wood chips or unscreened compost. This layer absorbs leachate from the pile and prevents pipe clogging.
3. Sludge and bulking mixture is placed on top of the pipe by a front-end loader to a height of 8 to 9 ft.
4. The pile is covered with a 6- to 8-in. layer of compost. This layer insulates the pile and helps maintain uniform temperatures throughout the mass.
5. The perforated pipe is connected through a section of solid pipe to a blower. The blower size depends on the system employed. A single blower controlled by a timer will handle 20 to 30 dry tpd of sludge.

The individual piles may be modified to form an extended system in which each day's sludge mixture is piled consecutively, utilizing the shoulder of the previous day's pile. This results in considerable saving of space, cover material, and base.

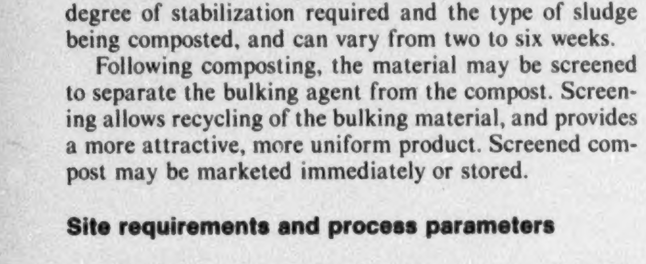
Once the blower is started, air is drawn or blown throughout the pile at a controlled rate, providing optimal conditions for microorganisms to effectively degrade the material. Time required for composting depends on degree of stabilization required and the type of sludge being composted, and can vary from two to six weeks.

Following composting, the material may be screened to separate the bulking agent from the compost. Screening allows recycling of the bulking material, and provides a more attractive, more uniform product. Screened compost may be marketed immediately or stored.

Site requirements and process parameters

The surface of a composting site must be sufficiently compacted for all-weather operation. Former landfill sites may be used, or a site can be prepared using gravel, asphalt, or concrete. A one-acre site will handle approximately 7 to 8 dry tons of sludge (35 to 40 tons at 20% solids). No special cover or housing is necessary, even in extreme weather conditions. Composting of sewage sludge is now being done in the open at Bangor, Maine, Windsor, Ont., and other northern municipalities, without any weather-related problems.

FIGURE 2: **Schematic diagram of forced aerated pile method of composting sludge**



Leachate from compost piles is minimal and, if necessary, can be collected and returned to the treatment plant or applied to the land by irrigation.

The composting process will be most efficient and cost-effective if performed under optimum and controlled conditions. Several parameters, such as oxygen level, free pore space, moisture content, and carbon/nitrogen ratio must be considered in light of the unique characteristics of each sludge. These parameters can be determined rapidly and efficiently, using a bin composter designed expressly for that purpose.

Compost marketing

As with all marketing questions, it is impossible to prescribe a solution that will be specific for each mill situation. An important aspect of any feasibility study of composting will be an analysis of possible utilization options. Factors that will affect the utilization of the compost, potential uses for the compost, and alternative distribution scenarios are discussed below.

The primary factors that will determine the best use for the compost are as follows:

- Quality of the compost
- Distance to the market
- Volume of compost produced
- Potential for in-house utilization.

The quality of the compost produced from pulp and paper mill sludge is a direct reflection of the sludge from which it is produced. The sludge is a combination of organic matter, conditioning chemicals, clays, and other inert materials; therefore, the compost is made up of the same material. Depending on the proportions of these materials, the compost can either be an excellent general soil conditioner, or be useful for specialized markets only. A second aspect to be considered is the distance from the source of production to the market. Since compost has a low weight per unit of volume, transport costs can be a significant element in the overall cost. It is possible to overcome this problem by enhancing the compost through nutrient addition or by bagging. Either option will add to the cost of production, but could open up a specialty market that would offset the additional costs.

A third issue is the volume of compost that will be produced. It is important to balance supply with the demand for compost. If several facilities are producing compost in the same area, it may be logical to develop a single brand name so that it will be easier to market the material. Alternatively, it might be necessary to utilize the compost for lower-value uses to ensure that it can all be sold, rather than try to obtain top prices.

Finally, a mill should explore the potential uses for the compost internally. For example, the compost can be used in reforestation efforts, as a potential odor scrubber, or as a source of fuel for the mill boilers.

Historically, the largest users of composts have been in agriculture and landscape work. People in these businesses are constantly looking for stable sources of high-quality, uniform organic matter to enhance the quality of their soil. In the past several years, rapidly escalating costs for peat have made it uneconomical for many uses. Consequently, these users might be an ideal market for certain pulp and paper mill sludge composts.

Due to its high exchange capacity, compost has proven to be an excellent medium for absorbing odor. For years, Europeans have utilized compost in this manner. And a sewage treatment plant in Windsor, Ont., is utilizing compost it produces to scrub plant odors.

A third use of compost would be as boiler fuel. The composting process utilizes biological energy to drive off water in the sludge. In the biological process, the volatile components of the sludge are converted into energy, which is available to vaporize the sludge water. The net result is a product (compost) that is easier to handle, has a lower moisture content, and is more easily stored than the sludge from which it is produced.

Process economics

In the following example, compost costs are developed for a hypothetical mill producing 10 dry tpd of 20%-solids sludge. The compost facility will be moderately capital-intensive and will be located close to the source of sludge. Costs in this analysis are based on 1982 prices. These costs and the final site design would, of course, be modified to take into account such factors as availability of land, costs of labor, capital funding availability, and source and type of bulking agent. With composting it is comparatively easy to design a very basic and inexpensive facility utilizing existing plant equipment, and then to upgrade the compost site as necessary over time.

This analysis assumes that all new equipment will be purchased and new personnel will be hired. The experience of the authors is that most plants have at least some available equipment, as well as plant personnel already involved in sludge handling.

Capital requirements are summarized in Table 1. These costs are based on a fully paved, contoured compost site, and include a building for compost drying and screening. This building is necessary if the bulking agent is unavailable, or if there is a constant need for the compost product. If bark is plentiful, is utilized as the bulking agent; and if the compost will be used on the plant's grounds, then it might be possible to operate the screens only at infrequent intervals. Consequently, the drying building would not be necessary. Also, if compost is to be used as fuel in the boilers, it might be possible to reduce the building size and eliminate the screening option.

Total capital costs for the 10-ton compost site described above would be $699,062, including the drying building, screening/grinding equipment, and their related engineering and contingency costs.

Operating and maintenance costs are shown in Table 2. Two people are required to operate the facility. It may be necessary to augment this labor with another person for certain tasks, depending on the end use of the compost and other engineering and design factors. In this analysis, it is assumed that bark or other suitable bulking agent can be obtained at no cost. The total operating and maintenance costs are about $133,000/year. These operating costs are quite conservative in nature, since a very high annual maintenance cost amounting to almost 4% of the total annual costs is assumed. It is doubtful that such costs would be incurred for the first several years of operation, at least.

The annual costs are the sum of the amortized capital costs and actual operating expenses. For the site costs calculations, a 15% interest rate and 20-year amortization period was used; for the moving equipment, a 15% interest rate and 10-year amortization was used.

Total annual amortization costs, including the building and screen/grinder, are $106,595/year. If the building and screen are not needed, the annual amortization costs drop to $55,563. Total costs, including operating costs, are then $239,964 for the most costly option, and $164,932 for the facility with no building or screen. This works out to a cost of $63.43 to $92.29/dry ton of sludge, or $12.68 to $18.46/wet ton of sludge, based on a 5-day/week operation.

Each dry ton of sludge will produce approximately 6.5 yd^3 of compost for marketing. Compost from municipal treatment plant sludge has been sold for between $3.00 and $12.00/yd^3 in bulk. Using these figures, it seems possible to recover between $19.50 and $78.00/dry ton of sludge composted. This income can substantially offset the costs of treating the sludge by this environmentally effective manner. P.H. Glatfelter Paper Co. (a detailed article on this installation will appear in a future issue of PULP & PAPER) is currently selling its compost, which reduces operating costs at its Spring Grove, Pa., mill.

Another positive aspect of composting is that most of the annual operating costs can be quite carefully controlled. Very few of the costs are subject to inflationary pressures. Energy costs in particular are quite low.

A factor that has not been considered in this analysis is the effect of investment tax credits and other tax credits, which could be associated with implementing a composting operation. □

TABLE 1: **Capital costs for 10-dry-tpd composting plant**

Site	**Unit cost**	**Cost**
Cleaning/grubbing	$ 0.62/yd^2	$ 4,803
Grading	1.00/yd^2	7,747
Base and paving	12.00/yd^3	92,961
Drainage pipe	20.00/linear ft.	7,041
Electrical	lump sum	10,000
Building[1] (slab, frame, and roof)	20.00/ft^2	200,000
Blower stations	2000.00 each	20,000
Subtotal site costs		$342,552
Moving equipment		
Front-end loader		120,000
Moving device		50,000
Screen/grinder plant[2]		70,000
Subtotal moving equipment		$240,000
Subtotal capital costs		585,552
Engineering and contingency costs		116,510
Total capital cost		$699,062

1. Building for screening and compost drying is optional, depending on site and compost use.
2. Screening plant is optional, depending on compost use.

TABLE 2: **Operating costs for 10-dry-tpd compost site[1]**

Item	**Unit cost**	**Annual cost**
Labor	$16,000/person/yr	$ 32,000
Fringe	30% of labor	9,600
Disposable pipe	$ 0.25/ft	6,641
Maintenance	5% of site costs[1,2]	17,128
	20% moving equipment cost[1,2]	48,000
Energy		
Diesel fuel	$1.20/gal	12,000
Electricity	$0.06/kwh	8,000
Total annual operating costs[3]		$133,369

1. Based on five day/week operation.
2. Operating costs include building, screens, and grinder.
3. Assume bulking material available at no cost.

Timber ownership still big factor for success in the paper industry

Survey of timber ownership, valuation, and self-sufficiency shows Weyco still leading in timber value, with IP next, followed by Georgia-Pacific

By THOMAS P. CLEPHANE and JEANNE CARROLL

☐ Timber ownership should continue to be an important element for success of companies in the increasingly integrated forest products industry. At normal levels of economic activity, there has been a long-term squeeze on the availability of accessible timber of desirable species and quality, primarily for softwood pine and fir in the Northwest and the South. This condition has resulted in a sustained and substantially faster rate of increase in both western and southern timber prices than in the general inflation rate over the past five to ten years.

From late 1981, timber prices are expected to rise 1% to 3% faster than inflation for the following reasons:

- Although demand is expected to moderate because of a lower level of housing starts, the decline in the rate of increase of timber growth should be even greater. As a result, the substantial gap that exists between timber harvest and growth at present should narrow appreciably.
- The Forest Service forecasts a 32% drop in supplies from forest industry lands in the Northwest by 1990, owing to persistent overcutting of old-growth timber and the extended time period—at least 20 years—before new growth reaches maturity.
- The U.S. is the low-cost timber and paper producer for expanding export markets in Asia and Europe.

Because much of the expected rise in demand reflects stronger markets for pulpwood, primarily in the South, prices of southern softwood timber are expected to rise faster than those of western grades, and values for pulpwood as well as sawtimber should increase in real terms.

Importance of timber ownership

Timber as a raw material is a significant element in the total cost of producing wood and paper products.

In the wood products area, the companies that have grown the fastest have owned low-cost timber bases. Profits from harvesting owned timber have provided a rising level of sustainable earnings taxed at the 28% capital gains rate, while the manufacturing value added has been extremely volatile.

With timber far-and-away the single-largest element of manufacturing costs (60% to 70% of the total), the major timber-owning companies have been expanding their market shares in the fragmented, slow-growth wood products industry. From 1969 through 1979, Georgia-Pacific Corp. and Weyerhaeuser Co. increased their combined lumber and plywood production at a 7% compound annual rate, while total industry output rose only 2%/year.

In the sharp 1979-81 contraction, these two dominant companies showed only a 5% drop in lumber and plywood output, as their market share increased strongly in the face of large declines in industry output. During the anemic housing recovery expected for 1983-84, nonintegrated producers should be hard-pressed to earn more than marginal profits because of the severe cost pressures from high-cost timber contracts arranged from 1979 through mid-1981. A substantial contraction in western wood products output is expected, with business continuing to shift to the South, where timber, labor, and freight costs are lower.

In the paper area, timber ownership is less important than in the wood products sector because labor and capital costs are relatively higher. The cost of delivered timber, which includes a substantial element of labor input in harvesting and delivery, amounts to 20% to 30% of total manufacturing costs, with labor representing another 20% to 25%. The industry is very capital-intensive, with a one-to-three ratio of sales to plant investment. There are examples of paper companies with small timber resources whose success has resulted from concentration on specialty products or the above-average efficiency level of their manufacturing plants. But timber ownership should continue to be an important advantage for certain companies in the paper industry, particularly for more timber-intensive products like linerboard.

Thomas P. Clephane is a vice-president and Jeanne Carroll a security analyst in the research department of New York-based investment firm, Morgan Stanley & Co. Their recently released 153-page biannual Timber Survey covers holdings of 97 companies.

Rising investment in timberlands

The increasing value of timber assets and the low-cost position of the U.S. in world markets makes timber ownership appealing for corporate and individual investors both within and outside the existing industry.

At least 30 publicly owned companies have acquired substantial amounts (at least 50,000 acres) of timberland since 1973, including 15 of the largest forest products and paper companies, most of which have publicly announced programs for the continuing purchase of timberland. Fifteen other firms, including nine diversified companies, also have acquired considerable timber holdings. In addition, purchases by private companies or investment syndicates have increased significantly in the past two years, with ten separate private transactions involving timber properties.

With capital investment costs still rising and stock values depressed, forest products and paper companies may find that an acquisition, even at substantial premiums over present stock prices, is the cheapest way to increase timber as well as plant assets. Since 1976 there have been 28 acquisitions completed in the U.S., each with a transaction value of over $60 million, for a total consideration of $6.04 billion in cash and stock. Ten of the deals involved plant assets only, six involved timber assets only, and 12 involved timber as well as plant assets.

Since early 1980, there have been 14 separate purchases of timberland with a minimum value of $25 million, encompassing every region of the U.S. Total value of these timber purchases was $1.2 billion. In addition, there was a frenetic round of acquisition activity in Canada during the 1980-81 period, involving nine separate transactions and total payments of US$3.05 billion.

Methodology of timber survey

Timber holdings for the 22 largest paper and forest products companies, categorized into eight geographic regions within North America, are shown in Table 1. Owned acres only are considered, since timberland controlled as a result of most types of stumpage contracts does not carry guaranteed fixed prices and/or long-term supply.

Although the subject of stumpage agreements is very complex, there are generally three categories other than fee ownership:

1. Goverment timber sale contracts are most prevalent in the West and usually contain a three-year limit on cutting rights. Prices are fixed according to competitive bidding west of the Cascades, and the contracted volume must be cut within the limit of the term; in other areas, there are escalation/de-escalation clauses tied to end-product prices;

2. Canadian provincial licensing arrangements are usuallly long-term in nature, with escalation clauses tied to end-market prices;

3. Timber purchase agreements are most prevalent in the South, where there is substantial private timber ownership. In some limited cases, these contracts can be considered similar to private ownership rights, with fixed payments for the timber and supply guaranteed over the

TABLE 1: **Acres owned in North America (at year-end 1981; thousand acres)**

	United States						Canada		
Major forest products/ paper companies	**North-west**	**Inter-mountain**	**Calif.**	**South**	**Central**	**New England**	**British Columbia**	**Eastern**	**Total**
Weyerhaeuser	2215	655	—	3002	—	—	—	58	5930
International Paper	377	—	103	4622	375	1425	—	—	6902
Georgia-Pacific	597	—	200	2554	302	580	—	380	4613
Crown Zellerbach	664	185	—	856	—	—	274	—	1979
Champion International	308	683	148	1454	434	—	42	—	3069
St. Regis Paper	153	311	—	1516	156	1078	—	—	3214
Boise Cascade (A)	284	1158	—	554	327	715	—	24	3062
Pacific Lumber	—	—	167	—	—	—	—	—	167
Scott Paper	242	—	—	740	—	862	—	1002	2846
Potlatch	—	614	—	554	247	—	—	—	1415
Union Camp	—	—	—	1728	—	—	—	—	1728
Louisiana-Pacific	—	130	570	150	48	—	22	—	920
Willamette	222	—	—	250	85	—	—	—	557
Mead	—	—	—	752	824	—	—	—	1576
Great Northern Nekoosa	—	—	—	366	258	2159	—	—	2783
Longview Fibre	342	84	57	—	—	—	—	—	483
Masonite (B)	—	—	106	361	22	—	—	—	489
Westvaco	—	—	—	525	750	—	—	—	1275
Kimberly-Clark	—	—	—	564	—	—	—	104	668
Chesapeake Corp. of Va.	—	—	—	364	—	—	—	—	364
Federal Paper Board	—	—	—	380	—	—	—	—	380
Hammermill Paper	—	—	—	176	183	—	—	—	359
Total	**5404**	**3820**	**1351**	**21,468**	**4011**	**6819**	**338**	**1568**	**44,779**

(A) Southern timberland includes 50% of 651,000 fee and fixed lease acres in Boise Southern (La.) and 228,000 net acres in the Carolinas, including a 25% interest in 90,000 held by a separate investment partnership.
(B) In early August, the company announced plans to spin off its timberland and lumber properties to a liquidating partnership to be owned by the shareholders. The limited partnership to be created is subject to Masonite Corp. shareholder approval.
Source: Morgan Stanley

life of the contract—which typically runs 30 to 60 years. Most of these agreements have some form of escalation, usually tied to a broad price index. Because most of the contracts were signed in the 1950-60 period, stumpage payments in some cases are substantially below current timber values and represent a significant corporate asset.

International Paper Co. is the largest timber owner in acreage, with 6.9 million acres in North America, followed by Weyerhaeuser with 5.9 million acres, G-P with 4.6 million, and Crown Zellerbach with 2.0 million. In addition, a number of "diversified" companies not shown own substantial acreage—such as Bowater Corp., with 2.7 million acres; Time Inc., 1.6 million; Burlington Northern, 1.5 million; Continental Group Inc., 1.5 million; ITT Rayonier Inc., 1.2 million; and Procter & Gamble Paper Products Co., 1.0 million. Largest Canadian paper company timber owners are CIP Inc., with 1.4 million acres and MacMillan Bloedel Ltd., with 1.1 million acres.

A sharp variance can be found in commercial timber inventory per acre in different regions. The Northwestern regions have been narrowly defined to include only Washington and Oregon (west of the Cascade Mountains). This region is primarily composed of Douglas fir, the most dense and valuable timber stands. Timber stocking becomes less dense in the Intermountain region of eastern Washington and Oregon, California, Idaho, and Montana, since rainfall is not as great and also because of the predominance of pine species. In addition, it is important to note that timber stands are about two-and-a-half to three times more dense in the Northwest than in the South.

Estimates of commercial timber inventory for various companies are shown in Table 2. Because of the higher timber density in the Pacific Northwest, Weyerhaeuser ranks first in timber inventory, followed by IP and G-P.

Estimated value of timber assets

In translating these inventory figures into valuation data, best estimates for market value of sawtimber, pulpwood, and land were used for each of the eight geographic regions—with a common 25% volume discount applied to all of the figures above $1 billion in value. In normal economic times, timberlands with an economic value of $1 billion could change hands without a significant discount, but in the present depressed economy, the market for large volumes of timber has dried up.

Timber in the Northwest and Intermountain regions is almost exclusively more valuable sawtimber, while timber in the Northeast and Central regions is assumed to be predominantly pulpwood. Southern timber values are composite, reflecting the present harvest pattern of 40% sawtimber and 60% pulpwood.

Because of the wide differences in timber stocking and values, the average acre of timberland in the Northwest has a market value (before the 25% discount) of $3280; in the Intermountain region, $800; in the South, $735; and in the Northeast, $188. The wide disparity in these figures points up the need to focus on a more sophisticated measure of timber-ownership value than total acres owned.

The estimated value of timber and land owned by the top 22 companies is also shown in Table 2. These figures

TABLE 2: **Estimated timber valuation**

Major forest products/ paper companies	Timber inventory (million ft³)				Estimated value timber & land (A) (millions $)	Timber & land book value	Estimated timber value/ book value ratio	Estimated timber value /share ($)
	Total	Pacific Northwest	U.S. South	Other				
Weyerhaeuser*	10,814	6986	2930	898	8035	620	12.96	60
International Paper	8563	566	5668	2329	3607	781	4.62	73
Georgia-Pacific	6010	1194	2894	1922	2781	752	3.70	25
Crown Zellerbach	3358	1610	1070	678	2049	259	7.91	69
Champion International*	3541	379	1325	1837	1686	465	3.63	28
St. Regis Paper*	4068	442	1421	2205	1557	218	7.14	45
Boise Cascade*	3748	568	549	2631	1502	290	5.18	56
Pacific Lumber	1336	—	—	1336	1167	4	291.75	45
Scott Paper	3371	581	770	2020	1083	92	11.77	25
Potlatch*	2446	—	720	1726	977	214	4.57	64
Union Camp	1728	—	1728	—	914	160	5.71	38
Louisiana-Pacific	1678	—	173	1505	886	189	4.69	29
Willamette	1057	622	350	85	955	327	2.92	63
Mead	1816	—	827	989	697	43	16.21	26
Great Northern Nekoosa	2871	—	402	2469	660	86	7.67	41
Longview Fibre	713	547	—	166	612	103	5.94	54
Masonite	580	—	289	291	466	43	10.84	38
Westvaco	1350	—	525	825	462	143	3.23	18
Kimberly-Clark	682	—	620	62	420	36	11.67	18
Chesapeake Corp. of Va.	291	—	291	—	216	33	6.55	34
Federal Paper Board*	286	—	286	—	215	59	3.64	28
Hammermill Paper	444	—	188	256	163	33	4.94	19
Total	**60,751**	**13,495**	**23,026**	**24,230**	**31,110**	**4950**	**6.28**	

*Timber inventory estimated by company

(A) Note: Volume discount has been applied to timber values above $1-billion. This 25% discount applies to the first 12 companies.

Source: Morgan Stanley

should be considered gross approximations, but they are useful in comparing relative timber asset values for each company.

Weyerhaeuser, with timber inventory valued at about $8.0 billion, is the dominant owner of timber. IP is a distant second, with $3.6 billion, and G-P is third with $2.8 billion. The timber holdings of the 22 major paper/forest products companies total 44.8 million acres, with an appraised value of $31.1 billion. This appraisal represents a 14.6% decline from the aggregate value of $36.4 billion for 45.4 million acres published in the 1980 Morgan Stanley Timber Survey (P&P, Nov. 1980, p. 72).

Estimated timber value for the 22 companies is 6.3 times greater than the $4.95 billion stated book value of their timber assets. Combined book value of nontimber assets for the 22 leading companies totals $18.3 billion, comprised of $24.8 billion in-plant plus $5.5 billion in working capital, with deductions of $10.8 billion for long-term debt and $1.2 billion for other net liabilties (mostly deferred taxes).

Adding the appraised timber value of $31.1 billion results in an aggregate timber-adjusted book value figure of $49.4 billion. This compares with a stated combined book value of $23.2 billion and an aggregate stock market value of $16.4 billion. It is apparent that combined market value of the 22 major companies in the industry is 29% below stated book value and at a substantial 67% discount to timber-adjusted book value.

Timber consumption and self-sufficiency

Table 3 presents data used to calculate each company's timber self-sufficency ratio of growth relative to consumption. Consumption of timber has been estimated for major categories of paper and wood products using common conversion factors. Timber growth factors have been developed by applying growth rates for each region adjusted for its quality (primarily a function of soil type, rainfall, etc.) and the magnitude of a company's long-term investment in intensive forestry management (or plantation) programs. Derivation of the annual growth rate is based on Forest Service studies and discussions with companies and forestry consultants.

The standard measure of self-sufficiency relates a company's present harvest to its total net consumption requirements. This measure of current self-sufficiency shows that only Weyerhaeuser and Pacific Lumber Co. supply virtually all of their consumption needs from their present harvests. CZ, Potlatch Corp., and G-P are at least 51% self-sufficient, followed by Boise Cascade Corp. at 46%, Champion International Corp. at 45%, and Scott Paper Co. at 43%.

A second measure of self-sufficiency relates timber growth (with the present level of plantation acreage) to current consumption. This calculation indicates that five companies (mostly western-oriented) are harvesting at a level somewhat in excess of growth, while another six firms are in rough balance. The data indicate that four companies—Chesapeake Corp., Kimberly-Clark Corp., Federal Paper Board Co., and Longview Fibre Co.—have current timber growth that is at least double their 1981 harvest, so that they can increase their cut meaningfully as these plantations mature. Union Camp Corp. and IP are growing about 70% more than the present harvest, while Hammermill Paper Co. is growing 56% in excess of cut. Union Camp has 49% of its acreage in plantations, the highest percentage among the major companies. □

TABLE 3: **Timber consumption and growth data**

		(Million ft^3)					
Major forest products/ paper companies	**Timber inventory**	**1981 net consumption**	**Estimated timber growth**	**1981 timber harvest**	**Timber growth to inventory**	**Ratio of timber growth to consumption**	**Timber harvest to consumption**
Weyerhaeuser*	10,768	762	661	743	6.14	86.75	97.51
International Paper*	8563	782	453	274	5.29	57.93	35.04
Georgia-Pacific*	5706	687	327	350	5.73	47.60	50.95
Crown Zellerbach*	2865	268	162	180	5.65	60.45	67.16
Champion International*	3539	397	224	177	6.33	56.42	44.58
St. Regis Paper*	4068	397	165	130	4.06	41.56	32.75
Boise Cascade*	3731	376	154	172	4.13	40.96	45.74
Pacific Lumber	1336	19	22	19	1.65	115.79	100.00
Scott Paper*	2549	230	101	99	3.96	43.91	43.04
Potlatch	2446	151	78	94	3.19	51.66	62.25
Union Camp	1728	302	156	90	9.03	51.66	29.80
Louisiana-Pacific*	1656	275	73	55	4.41	26.55	20.00
Willamette	1057	146	53	44	5.01	36.30	30.14
Mead*	1816	313	93	69	5.12	29.71	22.04
Great Northern Nekoosa	2871	293	79	95	2.75	26.96	32.42
Longview Fibre	713	82	52	22	7.29	63.41	26.83
Masonite	580	122	48	42	8.28	39.34	34.43
Westvaco*	1350	221	79	77	5.85	35.75	34.84
Kimberly-Clark*	620	102	51	19	8.23	50.00	18.63
Chesapeake Corp. of Va.	291	67	29	9	9.97	43.28	13.43
Federal Paper Board	286	93	34	13	11.89	36.56	13.98
Hammermill Paper	444	131	25	16	5.63	19.08	12.21
Total	**58,983**	**6216**	**3119**	**2789**	**5.29**	**50.18**	**44.87**

*U.S. operations only

Source: Morgan Stanley

Sudden roofing felt shift to glass slashes organic mills' market share

Glass mat roofing felt machines to make 60% of all shingles in 1982; four new fourdriniers now on order and several more still under study

By DAVID R. ALLAN, News Editor

☐ Depressed conditions in the housing market have driven building products companies into their deepest tailspin of the postwar era, and yet virtually all producers of roofing felt have either invested in new capacity in recent years or are studying plans to do so—and not an ounce of the fiber for those new machines will come from wood. Despite the most dramatic building products capacity swing in recent years, however, the technology being used by the new installations is fairly familiar to the paper industry: the inclined-wire fourdrinier.

Exciting though a major capacity switchover may be, the depressed condition of the housing industry means companies are basically stealing market share from their organic felt machines to give to their fiberglass mat machines. And the end result of the 50% increase in capacity scheduled for the next 12 months—with four new Sandy Hill machines scheduled to come on-line between October 1982 and the end of 1983—could be that organic felt machines can't be shut down fast enough to keep the new units going full-out.

Insignificant in the roofing industry until the late 1970s, glass shingles gained market share with the rising price of asphalt, and market share began to explode in 1980 and 1981. Representing about 18% of asphalt roofing in 1980 according to Census Bureau figures and 42% to 46% in 1981 according to industry executives, fiberglass-based shingles should take close to 60% of the total shingle market this year, with glass rolls taking 50% of the smaller built-up roofing market, according to industrial consultants John Starr and Zeb Renaud. Starr and Renaud, authors of an extensive study on this area published in 1979 and recently updated, believe that share could rise to 81% by 1987.

Shingle demand weak. The market is smaller in 1982 than it was in the late 1970s, due to the housing depression, of course. Therefore, roofing felt mill operating rates for all of 1982 will not reflect a runaway market.

The Asphalt Roofing Manufacturers Assn. estimates total production tumbled by 22% between 1979 and 1981. One manufacturer said about 309,000 tons of glass and organic mat went into roofing shingles and commercial roofing rolls in 1981. About 124,000 tons of this is glass mat, which is expected to rise to over 160,000 tons in a 1982 roofing market that should remain close to 300,000 tons of total production.

One executive calls the changeover an artificial market shift being forced by producers idling old organic felt mills to get maximum-possible running time in a soft market out of their new glass mat units—thus keeping ahead of financing costs. Demand for shingles and roofing rolls in 1982 was expected to be about level with 1981, with only a slow gain projected for 1983. Consumers have shown no striking preference for one type of shingle over the other.

Starr and Renaud think production of glass mat for shingles will rise from 50,000 tons in 1979 to 158,000 tons in 1982—and to 270,000 tons in 1987. Since demand for roofing products is not expected to rise at the same rate, that implies shutdown of a significant amount of organic felt capacity.

Machines running full-out. This fall, both fiberglass mat machines and units producing organic felt were enjoying healthy operating conditions, with glass machines running virtually full-out in most cases. Most roofing felt mills took extensive downtime during an unusually slow first quarter, and observers say inventories virtually disappeared. Then, when the building season got into full swing in the summer, mills began running on heavy schedules to catch up. As a result, both roofing prices and fiberglass strand prices have begun to recover from early 1982 softness. Once the building season is over, many observers think extensive downtime will once again become common.

Even with a rising market share, times have not been easy even for companies that have converted to the new technology: one executive's estimate places total glass mat paper machine capacity installed in 1981 at 157,000 tpy in fourdriniers and a further 15,000 tpy in dry-process machines, indicating the glass mat portion of the industry was running at about 72% of capacity last year.

Although glass mat market share will grow this year, capacity grew by about 23,000, too; the startup of Celotex Corp.'s new four-meter Sandy Hill unit in Russelville, Ala., kept operating rates below 90% for the year as a whole.

Twelve units installed. Only about 12 glass mat fourdriniers had actually been installed through the end of the third quarter of 1982. In addition to the four new machines now on order, other new capacity, which is believed to be under study, could complicate the situation further in the future.

Celotex designed its Russelville,Ala., mill with at least one more machine in mind. Georgia-Pacific Corp. now buys mat to produce roofing, but one observer suggested it will order a new machine as early as the first half of next year. IKO Industries Ltd., a Canadian company that this year bought a Bird & Son Inc. mill in Chicago, is thought to be another possibility for a new glass mat unit. GAF Corp. is also believed close to making a decision on a possible new machine.

Genstar Building Materials has placed an order that is typical of the type of machine now being bought by roofing products companies. Most are in the 60- to 80-tpd class, three to four meters wide—the Genstar unit is a four-meter machine, with a trim of 157.5 in., just 1.5 in. over four meters—producing a mat with 80% fiberglass and 20% binder. A typical binder would be urea-formaldehyde resin. Fourdriniers rather than cylinder machines—which are traditional for organic roofing felt—are used to produce wet-laid glass mat, with an inclined wire having an adjustable angle of inclination to allow for fiberglass's heavy drainage requirements, which can get up to 225 gpm/in. of face or more.

Dry process. Most glass mat is made by a wet process, although manufacturers such as Owens-Corning Fiberglas Corp.and CertainTeed Corp., as well as CertainTeed's French parent, Compagnie de Saint-Gobain, make some mat from a dry process using technology entirely alien to the paper industry. Some observers expect that the relatively slow production of the dry process will force its eventual abandonment in favor of wet-laid mat, and one executive pointed to OCF's choice of a fourdrinier for its new Aiken, S.C., capacity as a sign of that trend.

Sandy Hill Corp. and Voith Inc. are the major paper machine suppliers. Voith's machines are the outcome of cooperative efforts with Johns-Manville Corp.'s West German subsidiary, Glaswerk Schuller. The only machines now known to be on order in the U.S. are Sandy Hill's, while OCF has ordered a Voith four-meter machine for its European mill, with 1983 scheduled as the startup date.

All machines currently installed are in the Sun Belt, aside from two Johns-Manville machines in Waterville, Ohio. This is due to a problem with brittleness and cracking in the cold winters of the Northeast and Midwest. However, analysts expect product improvements to permit greater market penetration in the Frost Belt by the end of the decade, since a lower asphalt usage, longer life, and higher fire rating make glass shingles a more attractive product.

Market mat price worry. Uncertainties still plague this fast-growing market, however. Some felt producers, like Celotex, are considering joining Johns-Manville and OCF in producing their own glass strand in order to guarantee long-term fiber supplies.

Another concern relates to the expected overhang of fiberglass mat capacity in the next few years, which could force many producers to become aggressive sellers of market mat, depressing market mat prices. Currently Johns-Manville, with 38% of total glass mat capacity, is the major market mat producer, but Genstar's new machine may put it into a surplus mat position, and GAF could become a major market mat seller if it goes ahead with expansion plans.

European demand. While the U.S. glass mat market is growing at a rapid rate, European demand is rising at a more stately pace. However, Starr and Renaud project it will still increase by 40% between now and 1987, requiring approximately 54,000 tpy of mat at that time.

Europe's industry regularly shuts down machines for several weeks a year and typically gets much less production for the size of the equipment. According to Renaud, the two major producers of roofing felt in Europe are Saint-Gobain, with about 18,000 tpy of production using dry-process machines, and Voith, with about 16,000 tpy of production on two three-meter machines and a four-meter machine—the only such unit currently installed in Europe. Other producers active in European markets include Regina in the U.K.; OCF in the Netherlands; Isola in Norway; Ahlstrom in Finland; Andernach in West Germany; Vitrofil in Italy; and several others. None of these is believed to currently produce over 5000 tpy. □

TABLE 1: **U.S. fiberglass mat roofing felt machines**

Company	**Location**	**Capacity (tpy)**	**Supplier**
Celotex	Russelville, Ala.	23,000	Sandy Hill
CertainTeed	Athens, Ga.[1]	5500	CertainTeed
	Athens, Ga.[1]	5500	CertainTeed
CongLas	Bakersfield, Ca.	6000	Unknown*
Elk	Ennis, Tex.	20,000	Sandy Hill
GAF	Chester, S.C.	27,500	Voith-Schuller
Genstar	Los Angeles, Ca.	2000	unknown*
	Atlanta, Ga.	3000	unknown*
Johns-Manville	Waterville, Ohio	22,500	Voith-Schuller
	Waterville, Ohio[3]	22,500	Voith-Schuller
	Etowah, Tenn.	22,500	Voith-Schuller
Malarkey	Portland, Ore.	6000	unknown *
Owens Corning	Aiken, S.C.	18,000	Sandy Hill
	Santa Clara, Ca.[1]	1500	unknown
	Kansas City, Kan.[1]	1500	unknown
	Kansas City, Kan.[1]	1500	unknown
Tamko	Tuscaloosa, Ala.	7000	unknown*
Machines on order or reported to be under study			
Bird	Charleston, S.C.	25,000	Sandy Hill
Elk	unknown[2]	unknown	unknown
GAF	unknown[2]	unknown	unknown
Genstar	Ennis, Tex.	25,000	Sandy Hill
Johns-Manville	Etowah, Tenn.[2]	22,500	Voith-Schuller
Owens Corning	Aiken, S.C.	25,000	Sandy Hill
Tamko	Joplin, Mo.	18,000	Sandy Hill

1. Dry process machines
2. Reported to be under study
3. Partially converted to produce specialty grades other than roofing

* Believed to have been produced by independent entrepreneur Dan Appels

Source: PULP & PAPER estimates; John Starr/Zeb Renaud estimates

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December 1982

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Mill maintenance

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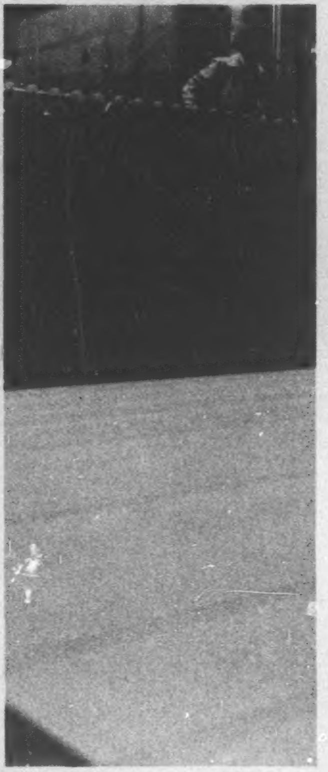

ST. REGIS EXPANDS SARTELL 82

COVER: *Two 10-roll, 2500-fpm supercalenders located in a pit below the operating floor of St. Regis' new LWC paper machine at Sartell, Minn. (feature story on this expansion begins on page 82). Photo courtesy of St. Regis.*

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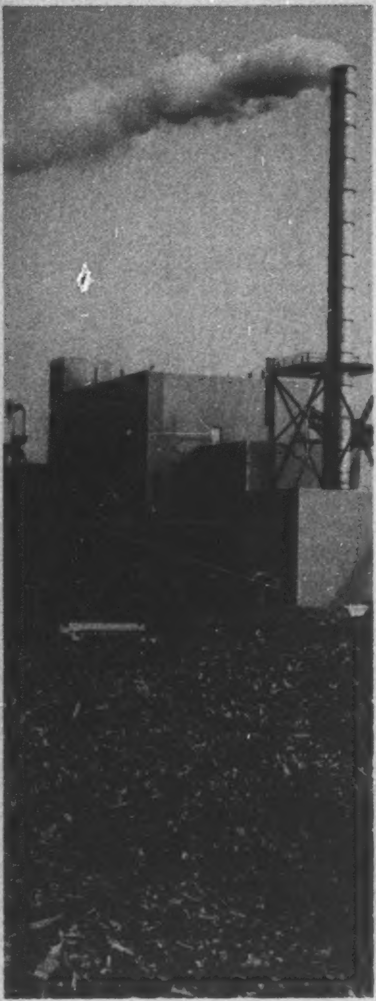

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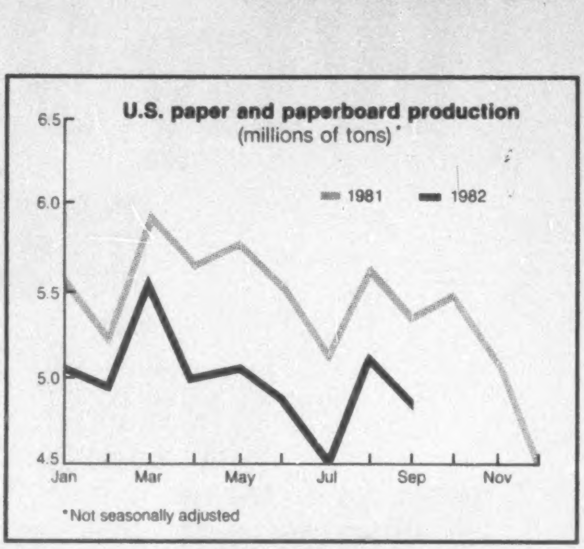
MONTH IN STATISTICS

U.S. paper and paperboard production in September totaled 4.8 million short tons, 6.2% below the September 1981 total, according to the American Paper Institute. The trend of production, as measured by the two-month moving average of the seasonally adjusted data, moved above the 5-million-ton level in September for the first time since March. However, total output for the first nine months of the year was 5.7% below year ago.

Among major grades, newsprint production is continuing to slow, reflecting reduciton in inventories at publishers. Uncoated groundwood production in September gained strength and was up 9.0% over year-earlier levels, while shipments of coated paper and uncoated free sheet dropped below last year's levels. In paperboard, September production was down substantially in all major grades, although production of unbleached kraft linerboard for export was up 20% over year-earlier levels.

Total Canadian newsprint shipments in September came to 601,000 metric tons, down 15.2% from September 1981, according to the Canadian Pulp & Paper Assn. Newsprint mill operating rates plummeted to 60% in September from 75% in August, and were well below the 83% rate of a year earlier.



		Latest month (000 short tons)	% change from year ago	Annualized year-to-date (000 short tons)	% change from year ago
PAPER & PAPERBOARD PRODUCTION[1]					
Newsprint	September	386	−12.5	5,089	−2.8
Uncoated groundwood (s)	September	121	9.0	1,425	−2.5
Coated paper (s)	September	422	−2.8	4,990	0.8
Uncoated free sheet (s)	September	627	−5.4	7,801	−2.6
Unbleached kraft packaging and industrial (s)	September	307	−3.8	3,654	−7.6
Tissue	September	345	−8.5	4,367	−3.6
Total paper	**September**	**2,444**	**-6.0**	**30,268**	**−3.3**
Kraft linerboard, unbleached	September	1,131	−6.7	13,703	−8.6
Semichemical medium	September	365	−4.9	4,407	−9.0
Bleached paperboard	September	286	−9.8	3,728	−7.0
Recycled paperboard	September	537	−8.2	6,664	−7.4
Total paperboard	**September**	**2,401**	**−6.6**	**29,579**	**−8.0**
Total paper and paperboard*	**September**	**4,846**	**−6.2**	**59,847**	**−5.7**
PULP, WASTEPAPER & FIBER[2]					
Total woodpulp production	August	4,226	−6.9	50,186	−5.3
Market pulp production	August	525	−9.6	5,874	−7.0
Wastepaper consumption at paper/board mills	August	1,188	−4.9	13,754	−3.7
Pulpwood consumption (cords)	September	6,758	−0.6	79,362	−1.7
CONVERTED PRODUCTS STATISTICS[3]					
Corrugated box shipments (billion ft^3)	September	20.657	−2.8	177.271†	−5.8
Containerboard inventories at box plants	Sept. 1	2,553	7.4		
INTERNATIONAL TRADE[2]					
U.S. paper imports (including products)	August	664	7.3	7,948	−4.7
Imports of Canadian newsprint	August	508	1.8	6,531†	−5.4
U.S. paper exports (including products)	August	335	−5.9	4,263	−12.9
Exports of unbleached kraft linerboard	September	154	20.3	1,922	−2.6
Exports of woodpulp	August	279	−7.0	3,491	−6.0
CANADIAN STATISTICS[4] (reported in metric tons)					
Total newsprint shipments	September	601	−15.2	5,952†	−9.2
Operating rates	September	69%	92%	83%	94%
Inventories held by U.S. consumers	Sept. 30	1,432	−1.9		
Woodpulp shipments (export only)	September	486	1.3	4,413†	−11.1
Operating rates	September	60%	83%	77%	86%

1. American Paper Institute. 2. API, Bureau of Census, American Pulpwood Assn. 3. Fiber Box Assn., Paperboard Packaging Council. 4. Canadian Pulp & Paper Assn.
*Includes construction and wet machine grades. †Not annualized. ‡Not directly comparable to year ago because of coding change. (s) = shipments.

FINANCE

U.S. paper profits still down in third quarter

U.S. paper industry profits continued to be hurt by weak domestic and international markets and general price erosion in the third quarter as the world recession showed no signs of easing. Downtime at pulp and paper mills was widespread, and most major U.S. paper companies reported both profits and revenues for the quarter below year-earlier levels. Despite gains from tax-rate adjustments and other accounting changes, paper industry profits fell 32% on a 6% decline in sales, according to a *P&P* survey of 28 firms.

For seven more firms with extensive forest-products holdings, the third-quarter earnings picture was worse: profits fell 61% while sales were off 4%. Earnings for the combined U.S. paper/forest products industry dropped 39%, and sales 5%.

IP profits plummet. "The dismal condition of the economy has made the third quarter a most difficult period for the forest products industry," said Edwin A. Gee, International Paper Co. chairman and CEO. IP reported profits of $32.4 million, 40% below a year ago, on sales of $986.2 million, down 23%.

"Specifically, high interest rates and the continuing recession in the U.S. and a strong dollar abroad have adversely affected industry operating rates which resulted in very competitive pricing in all of our product lines," Gee said.

Crown Zellerbach Corp. reported that third-quarter earnings improved slightly over 1981—rising 7%—but remained hurt by the recession and continuing losses by CZ Canada. Mead Corp. registered an operating loss of $20.1 million in the third quarter compared with profits of $22.8 million in third-quarter 1981. Mead also reported an extraordinary charge against earnings of $22.5 million from the $45-million settlement of its corrugated container antitrust case.

Wood products still declining. Companies more heavily involved in wood products were harder hit in the quarter, and many bolstered earnings through tax-rate adjustments or other accounting changes. Georgia-Pacific Corp. reported a loss of $1 million from operations for the third quarter, compared with income of $31 million in third-quarter 1981. However, an extraordinary gain of $27 million from an exchange of common shares for debt brought net income to $26 million.

Boise Cascade Corp.'s earnings tumbled 87% to $2.5 million, despite the fact that after-tax results were helped by a tax provision calculated for the nine months just ended. And Champion International Corp., whose profits were down 32% below year-ago, said results were aided by the sale of land in Texas and federal income tax accrual changes.

Canadian firms post losses. The worldwide recession continued to take its toll on Canadian financial statements in the third quarter, as most firms posted substantial losses for the period and revenues dipped below year-earlier levels, according to ten producers. Markets for newsprint and pulp continued to deteriorate, resulting in general pricing weakness, while wood products remained severely depressed.

The ten firms reported a combined operating loss of C$64.1 million compared with profits of $44.4 million last year, on sales of $2.3 billion, down 3.0% from year ago. Six firms operated in the red, including four major western firms who continue to be hard hit by virtually paralyzed wood products markets.

U.S. PAPER/FOREST PRODUCTS RESULTS

	Third quarter ($000)			
Paper companies	**Sales**	**Change 1982/81**	**Earnings[1]**	**Change 1982/81**
Chesapeake	$ 70,895	-19.0%	$2,678	-65.7%
Clevepak	44,346	48.2	950	-25.2
Consolidated	133,501	0.2	4,621[2]	-61.6
Crown Zellerbach	749,200	-5.2	7,400	7.2
Diamond	232,581	-8.0[3]	3,724	121.7[3]
Federal Paper	114,709	-3.3	2,739	-5.2
Fort Howard	150,948	16.4	24,932	9.2
Glatfelter	57,282	-20.7	4,294	5.8
GN Nekoosa	356,800	-5.0	17,400	-23.3
Hammermill	312,602	-0.2	5,969	-28.1
Int'l: Paper	986,200	-22.5[4]	32,400	-40.0[4]
James River (7/25)[5]	262,363	47.4	6,466	53.3
Kimberly-Clark	741,700	3.9[3]	54,000[6]	9.8[3]
Longview (7/31)[5]	88,576	-13.4	(1,416)	n.m.
Mead	680,469	-10.5[3]	(20,161)[7]	n.m.
Mosinee	22,640	-0.9	1,031	-42.8
Pentair	65,772	18.3	2,611	18.0
Publishers	62,900	-21.4	(5,700)	n.m.
St. Regis	690,297	-2.5	50,365	16.5
Scott	574,272	-0.2	22,475	-17.4
Sonoco	132,732	1.2	6,790	-30.1
Sorg	18,459	-17.6	56	-90.4
SW Forest	162,160	-16.0	(6,422)	n.m.
Stone Container	104,878	2.9	2,023	-68.5
Union Camp	374,733	-13.0	28,747	-35.2
Wausau (8/31)[5]	44,317	-14.8	86	-93.4
Westvaco	351,960	-10.4	16,431	-35.3
Willamette	246,911	-1.2	8,059	115.3
Total	**7,834,203**	**-6.2**	**268,824**	**-31.7**
Forest products				
Boise Cascade	736,670	-5.7	2,490	-86.5
Champion Int'l.	950,631	-5.8	16,607	-32.1
Georgia-Pacific	1,422,000	1.5	(1,000)	n.m.
Louis.-Pacific	228,300	-10.3	650	n.m.[8]
Pope & Talbot	66,147	24.8	1,451	n.m.[8]
Potlatch	212,733	-5.5	3,804	-42.3
Weyerhaeuser	1,024,323	-6.6	25,300	-49.5
Total	**4,640,804**	**-3.7**	**49,302**	**-61.3**
U.S. total	**12,475,007**	**-5.3**	**318,126**	**-39.0**

CANADIAN PAPER INDUSTRY RESULTS

Abitibi	C$388,265	-14.4	C$8,062	-76.0
B.C. Forest	185,300	43.8	(25,800)	n.m.
B.C. Resources	154,[illegible]	-8.3	(14,900)	n.m.
Con-Bathurst	339,900	-10.3	9,400	-66.4
CZ Canada	165,600	22.1	(10,200)	n.m.
Domtar	411,300	-13.2	(1,600)	n.m.
Fraser	101,300	-11.5	(2,242)	n.m.
Great Lakes	100,380	-28.9	936	-95.3[3]
Mac. Bloedel	427,000	19.1	(30,000)	n.m.
Scott	48,193	17.3	2,237	12.5
Total	**2,321,238**	**-3.0**	**(64,107)**	**n.m.**

1. Income after taxes, from continuing operations, excluding most significant nonrecurring items in both years.
2. Net income includes an after-tax charge of $6.2 million for plant closing.
3. 1981 figures restated by company.
4. Includes results of Canadian Int'l. Paper Co., sold in October 1981.
5. Period ended. Figures for James River are for first quarter, and reflect acquisition of American Can Co. on July 2, 1982. Wausau figures are for fourth quarter.
6. Includes gain of $8.3 million from sale of woodlands.
7. Net loss before additional $22.5-million charge from antitrust settlement.
8. Reported net loss in third-quarter 1981.

n.m.=not meaningful. ( )=loss.

Folding box industry buying more recycled paperboard to cut costs

Clay-coated recycled boxboard, solid bleached sulfate market shares shift in recession—future trend or temporary result of low wastepaper costs?

By DEBRA A. ADAMS, Assistant News Editor

☐ Paperboard grades preferred by the folding carton industry appear to be changing, at least in the near-term, and some producers of solid bleached sulfate (SBS) and clay-coated recycled boxboard believe an emerging emphasis on economy vs elegance in packaging could cause a permanent shift in markets.

According to some market observers, in the last two years an ever-increasing number of companies have been switching packaging of their products to clay-coated "newsback,"—which is the leading secondary fiber-based paperboard grade used in the folding carton industry—from SBS, the industry's more popular virgin fiber paperboard grade.

This practice reverses an earlier trend that caused clay-coated recycled newsback to lose market share to solid bleached.

The change is attributed to a number of factors, which basically stem from a worldwide economic recession, combined with improvements made in clay-coated newsback quality, observers say.

Companies cut packaging costs. Since 1980, companies have come under increasing pressure to reduce costs to make their products more competitive. Where it has been possible to do so, they have cut packaging costs by downgrading to cheaper packaging.

For SBS users, the most viable alternative has been clay-coated recycled paperboard.

According to the Paperboard Packaging Council (PPC), clay-coated news accounted for 39% of total folding-carton shipments in 1981, compared to 35.6% in 1980, while SBS's share dropped to 36% from 37.3% the previous year.

However, the U.S. Bureau of Census and American Paper Institute (API) data for market shares in the folding carton industry indicate that SBS has not lost market share.

The discrepancy that is found in the figures is attributed by some industry marketing executives to the different sources used. PPC compiles its statistics from converters, while API and the U.S. Bureau of Census query the mills.

The U.S. Bureau of Census reported SBS accounted for an estimated 37.5% of the total 3.4 million tons of folding boxboard consumed in 1981, while the industry's consumption of clay-coated newsback accounted for just 36% of the market.

SBS and kraft board together comprised 50% of the folding-carton market in 1981, compared to 42% of the market in 1972.

Competition is close. Both sets of statistics, however, clearly point out that clay-coated news remains a close competitor for SBS. Furthermore, some feel that the competition is likely to become even more intense over the next few years.

Whether or not either grade will garner a majority of the market in the future is uncertain—and depends on a number of factors such as pricing and technological advances, as well as fuel, fiber, and other operating costs, observers say.

In recent years, the price differential between clay-coated newsback and solid bleached has widened considerably, giving recycled a significant competitive edge. Reduced overall costs enabled recycling mills to hold down their price increases.

TABLE 1: **Folding carton industry boxboard grade tonnage mix**

	1981	1980	1970	1960
Total kraft	48.0%	50.4%	40.9%	19.9%
Solid bleached sulfate	36.1	37.3	31.9	15.8
Solid unbleached sulfate	11.9	13.1	9.0	4.1
Total recycled	52.0	49.6	59.1	80.1
Clay-coated news	38.8	35.6	29.7	12.9
Other recycled	13.2	14.0	29.4	67.2
Chip	n.a.	4.7	9.7	12.6
Bleached manila	n.a.	2.1	5.1	15.8
Patent coated news	n.a.	2.0	9.2	29.8
Laminated	n.a.	3.5	3.9	7.0
Misc.	n.a.	1.7	1.5	2.0
Total kraft & recycled tonnage (000)	3274	3311	3075	2856

Source: Paperboard Packaging Council

Especially helpful has been the sharp drop in prices recycled mills pay for wastepaper, while higher energy costs have had a somewhat greater impact on virgin paperboard mills, even though a significant percentage of their total energy comes from burning spent pulping liquor, observers say.

Price gap widens. Early in the 1970s, SBS and clay-coated recycled prices were nearly the same on a per-1000-ft^2 (MSF) basis, observers say. Now, however, an 18-pt clay-coated board is more than $2/MSF less than a comparable 20-pt bleached board, according to one industry executive.

The price gap narrowed in September, though, when SBS producers dropped rollstock prices on 16-pt and higher calipers to $590/ton, essentially cancelling a July 1, 1981, price increase.

Recycled producers have reportedly kept posted prices at $425/ton for 20-pt clay-coated folding boxboard for some time. A considerable amount of discounting was reported, however, with one market observer saying that the ratio between SBS and recycled was still around $600/$400.

This indicated that at least in some markets recycled board pricing is roughly $25 below list figures.

Observers also report that solid unbleached sulfate (SUS) prices are nearly as low as clay-coated newsboard prices because of the intense price cutting occurring in the industry.

A drop of $25/short ton in September reduced 16-pt clay-coated kraft board to $475/ton, or $14.96/MSF compared to $14.15/MSF for a 16-pt clay-coated newsboard, said one executive.

SUS not a significant factor. Decline in the SUS price has reportedly not created a significant urge in demand. One boxboard consumer indicated that buyers are reluctant to commit themselves to using a SUS board because there are only two major suppliers.

One marketing executive expects SUS demand will continue to decline in the next few years because plastic two-liter bottles are replacing the need for six-packs of glass bottles in paperboard carriers.

PPC's report on folding paper box shipments in 1981 indicates that SUS demand dropped 9.7% and SBS was down 4.5%. Clay-coated recycled, by contrast, was up 7.8%.

Some market observers, however, feel that folding-carton market shares for recycled and virgin paperboard grades have been distorted by the recession, and will return to the same level as two years ago when the economy recovers.

During economic slowdowns, marketing executives say, consumers at the retail level change their buying patterns, which in turn causes a switch in the level of boxboard consumption.

For example, during recessions, consumers tend to buy less frozen food and more dry food, in addition to still purchasing a good amount of such staples as laundry detergent, toothpaste, and tissues, which are often packaged in recycled paperboard, while refrigerated foods tend to be sold in SBS board.

SBS gain in August. According to API figures for August, however, recycled paperboard production was down 7.4% for the first eight months of this year, compared to the same period last year, while solid bleached board was down only 6.6% for the same period.

The figures, however, include tonnage produced for the folding-carton industry, the largest market for both grades, as well as for other end uses.

But some observers say that the turn in the market began more than two decades ago and is not likely to be stopped now. In the 1960s, demand for clay-coated recycled increased at an annual rate of 9.5%, and in the 1970s demand was up 2.5% a year.

SBS demand, however, increased at slower annual rates of 8.1% in the 1960s and 2.3% in the 1970s. During this time, other grades of recycled paperboard declined significantly, opening up the market for clay-coated recycled board and SBS, as well as SUS.

Low recycled grades declining. Observers feel lower grades of recycled paperboard are likely to continue to decline while clay-coated newsboard and SBS will expand into that market. St. Regis Paper Co. president Edward J. McMahon feels the lion's share of that market will be captured by clay-coated newsboard. "We're confident we turned the corner in 1981 and are on our way up," he said.

A converting executive with a company that is also a major recycled board producer agrees. Plants operated by his company used to make about the same number of cartons from recycled as from bleached boards.

In the last two years, however, recycled is being used for 57% of the containers vs 43% made out of SBS. And, he expects by the end of the first quarter of 1983, that ratio will be more like 60%/40% in favor of recycled.

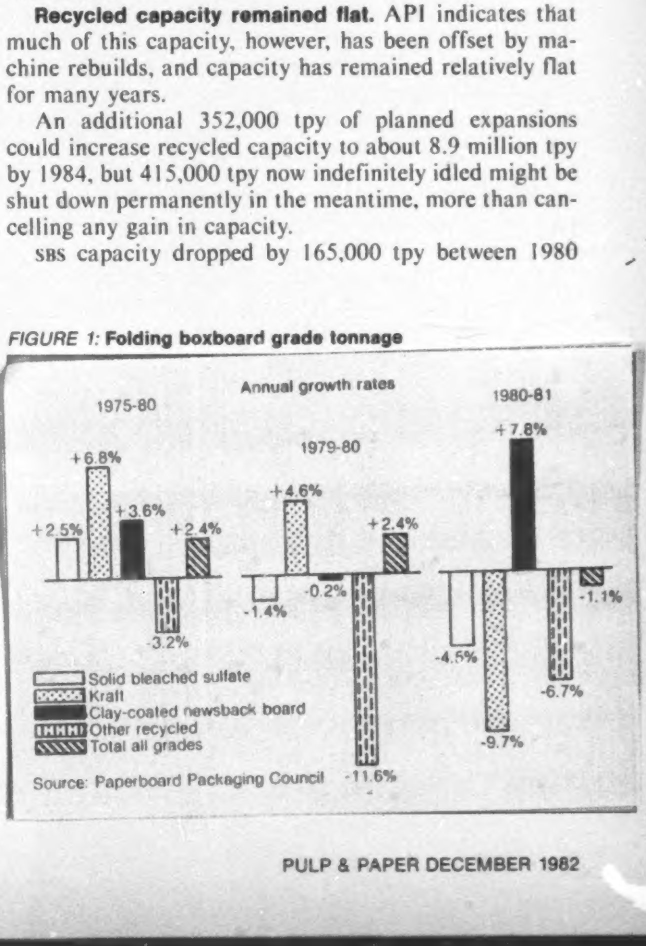
If clay-coated demand is actually heading upward in the next few years, though, its growth is likely to be prematurely stunted by insufficient capacity. Since 1970, a total of 75 recycled paperboard machines producing 2.2 million tons of all grades of recycled paperboard and accounting for 20% of capacity were shut down, says McMahon.

Recycled capacity remained flat. API indicates that much of this capacity, however, has been offset by machine rebuilds, and capacity has remained relatively flat for many years.

An additional 352,000 tpy of planned expansions could increase recycled capacity to about 8.9 million tpy by 1984, but 415,000 tpy now indefinitely idled might be shut down permanently in the meantime, more than cancelling any gain in capacity.

SBS capacity dropped by 165,000 tpy between 1980

FIGURE 1: **Folding boxboard grade tonnage**



Source: Paperboard Packaging Council

and 1981 because of producers allocating more machine time to making market pulp, and no new additions were planned as of late last year.

Earlier this year, however, International Paper Co. announced plans to increase SBS capacity at its Texarkana, Texas, mill by 100,000 tpy, and is studying possibly expanding its Pine Bluff, Ark., mill, which observers indicate would increase bleached board capacity by 50,000 tpy. Both projects would be completed by 1985.

A number of large users have switched from using solid bleached to clay-coated recycled board this year, including Duncan Hines on its cookie mix, Nabisco on its hot cereal boxes, and General Mills on its granola bar package.

Probably the most significant changeover in packaging, however, occurred this year when Procter & Gamble decided to use clay-coated newsback instead of SBS for its Pamper disposable diaper box.

Pampers switches to recycled. One executive noted that the Pampers decision should not be construed as a trend to downgrading, however, but rather as a natural evolution of an individual company's product. Pampers, he explained, has lost market share in recent years to elastic-legged diapers like Luvs and Huggies. This has induced P&G to reduce packaging costs and market Pampers as a less-expensive alternative to fitted diapers, he noted.

Bristol Myers, another large consumer of paperboard containers indicated it uses SBS for between 60% and 70% of its cartons and the remainder is made from recycled paperboard. Most of its products can be packaged in either, though, depending on what's available, noted a Bristol Myers purchasing executive.

Bristol Myers is considering increasing its consumption of SBS. Bufferin and Excedrin have both been switched to solid bleached paperboard packaging from clay-coated newsboard, and Ban roll-on and Mum deodorant packages also might be changed to SBS from recycled, said the company's paperboard buyer.

Bristol Myers, however, is looking at ways to reduce its packaging expenses, including possibly downgrading to recycled on some of its other packages or going to a lower density SBS board to make the cost comparable to a recycled board, said the buyer.

SBS still stronger, stiffer. Other companies have used the minimal packaging required to do the job for a number of years. Pillsbury's paperboard buyer indicated the company's buying patterns hadn't changed for years, and that they aren't likely to unless recycled producers are able to make a paperboard with comparable qualities to SBS—which is of a stronger and stiffer quality than newsboard.

In Pillsbury's case, for example, frozen foods cannot be packaged in recycled because it doesn't stack and hold up as well in high-humidity conditions and tends to darken when waxed.

Other manufacturers note that recycled will not be used to box such items as expensive toiletries because it doesn't connote the same quality as solid bleached. Also, packaging is considered to be a point-of-sale billboard and recycled does not print as well as SBS, some observers say.

Clay-coated news quality has, however, improved significantly in recent years, and some market observers say it even prints as well now as SBS, even in gravure and rotogravure printing. Technical improvements have also made newsboard more water-resistant and stiffer.

In addition, newer machines are able to make newsboard in calipers as low as 10-pt, as in the case of Federal Paper Board Co.'s Sprague, Conn., mill which has a Beloit Inver-Former machine that was installed in the mid-1960s.

A machine rebuilt with a Beloit Bel Bond former in the late 1970s at St. Regis's Battle Creek, Mich., mill produces calipers ranging from .012 to .026, and is expected to go down to .010 caliper eventually, according to McMahon.

Many recycled machines obsolete. Most recycled paperboard machines, however, produce boards of 16-pt caliper and higher. The majority are old cylinder machines that run at an average of about 400 fpm, according to one estimate.

A number of these older paper machines will probably have to be retired in the next several years, and this will probably have a significant impact on the market, which will have some impact on the competitiveness of recycled board.

One of the reasons that recycled producers have been able to offer their board at lower prices than SBS has been lower capital costs from operating older, depreciated facilities. If recycled board mills begin investing in newer machines, their capital costs will increase proportionately and will dull their competitive edge, according to observers.

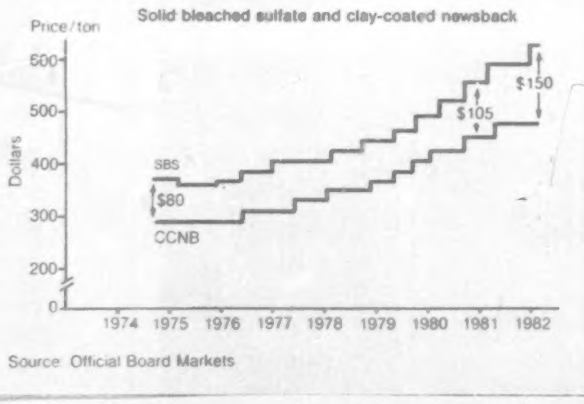
To keep their market share growing, recycled paperboard producers will have to keep their operating costs down.

One of the most significant factors in reduced expenses has been fiber prices, which in the past two years have been at historically low levels. Once the economy improves, however, wastepaper costs are expected to increase substantially. In addition, recycled board manufacturers will probably have to increase their prices as well.

Operating costs for solid bleached producers, however, are expected to decline. They have been investing in newer machines for some time and will start to get a better return on this investment as the economy picks up and these machines perform better.

In addition, SBS producers have more opportunity to reduce purchased energy costs through improving efficiency of their recovery processes and burning more woodwaste. ☐

FIGURE 2: **Folding boxboard price trends**



Source: Official Board Markets

Recession hits TiO_2 demand as imports increase

By BARRY SHOCKETT

In 1982, production of titanium dioxide (TiO_2) will drop to about 680,000 tons, down 9.3% from 1981. Reduced demand resulted in the closure of NL Chemicals' New Jersey plant on Sept. 10, which reduced industry capacity to 905,000 tons. However, NL will continue to market and produce slurry at its Sayreville, N.J., plant, using TiO_2 from its plants in Canada and Europe. This should result in increased imports next year. Currently, about 75% of imports come from Canada, Fed. Rep. Germany, France, and Spain. European shipments account for almost 60% of the total, the largest share (31.5%) held by imports from Germany.

The continuing slump in the construction and automative markets reduced Canadian demand by the paint industry by about 15%. As a result, due to excessive inventories, Tioxide Canada closed (for at least two months) one of its calciners at the beginning of September.

U.S. statistics for titanium dioxide (000 short tons)

	1979r	1980r	1981	1982e
Capacity	1000	1000	1005	972
Production	742	727	750.5	680
Imports	105	98	125	130
Exports	49	42	61	60
Apparent consumption	798	783	814.5	750

Source: Bureau of Census, U.S. Dept. of Commerce

Canadian statistics for titanium dioxide (000 short tons)

	1979r	1980r	1981r	1982e
Capacity (nameplate)	79.4	79.4	82.7	82.7
Production	77	78.8	80.5	76
Imports	12.5	6.9	8	6.5
Exports	17.1	14.3	15.8	17.5
Apparent consumption	72.6	71.4	72.7	65

TITANIUM DIOXIDE

UNITED STATES

Uses: Both rutile and anatase grades of TiO_2 are used as fillers and coating pigments by the paper industry in printing/writing papers and paperboard. The largest end use is in paints (50%), followed by plastics (12%), rubber, ceramics, and other miscellaneous applications.

Demand: In 1981, the paper industry consumed an estimated 183,000 tons up 4% from 1980. This represented between 22% and 23% of total TiO_2 demand. Mill usage was expected to increase 5% this year. However, the drop in paperboard output and the relatively poor performance of coated papers resulted in overall industry usage dropping to approximately 170,000 tons in 1982.

Sources: The remaining five U.S. producers, in descending order of capacity, are: E.I. duPont, SCM Glidden, American Cyanamid, Gulf + Western, and Kerr-McGee. NL Chemicals closed its plant early in September.

Availability: There is no shortage of TiO_2 and industry operating rates have been 81% to 82% for the past three years. 1982, market; 1981, market; 1979, market; 1979, anatase, market; rutile, tight.

Pricing: Prices have remained unchanged since August 1981, when the price of anatase and rutile grades rose 6c to 7c/lb, respectively, to 70c and 75c/lb. There has been substantial discounting that was sparked by competition from low-priced European imports. Pricing history: 1982, anatase, 70c/lb, delivered; rutile, 75c/lb; 1981, anatase, 58c-70c/lb; rutile, 63c-75%/lb; 1980, anatase/rutile, 57c/lb; 1979, anatase, 53c/lb; rutile, 59c/lb; 1978, anatase, 46c/lb; rutile, 52c/lb.

Forecast: Imports are expected to increase in 1982 by about 4%, while total demand should drop about 8%. Unless the economy improves significantly in 1983, titanium dioxide consumption will remain depressed.

CANADA

Uses: About 90% of the anatase titanium dioxide used by the paper industry is employed in fine paper mills, with paperboard applications accounting for the rest. The paint industry is the largest dioxide consumer, followed by plastics and other applications.

Demand: Paper industry usage in 1981 of 7200 tons (10% of total consumption) was down about 12% from 1980. Industry usage in 1982 is expected to increase by about 500 tons to 7700 tons. In 1981, the paint industry accounted for 59% of the total, while plastics' share was 16%. Imports increased last year about 16%.

Sources: The two domestic producers are NL Chem Canada (formerly Canadian Titanium Pigments) and Tioxide Canada. About 52% of the imports (11% of total demand) are from the U.S., the balance coming from Europe.

Availability: Despite an industry operating rate of between 95% and 100%, increased domestic demand could be satisfied by reducing exports, until new capacity comes on-stream. 1982, anatase, market; 1981, market; 1979, market; 1979, market.

Pricing: Prices for untreated anatase TiO_2 have remained steady since Jan. 18, 1982, when they rose to 80c/lb (up 5.5c/lb), bags, delivered. Pricing history: 1982, 74.5c-80c/lb; 1981, 69c-74.5c/lb; 1980, 5[illegible]c-69c/lb; 1979, 48.5c-59c/lb; Slurry shipments are 0.5c/lb extra.

Forecast: TiO_2 demand by the paper industry is predicted to increase 11% to 12%/year to mid-decade on the average. The average annual increase for total dioxide consumption is forecast to be 7.5%/year.

Mr. Shockett is consulting editor-chemical markets for PULP & PAPER.

PULP & PAPER

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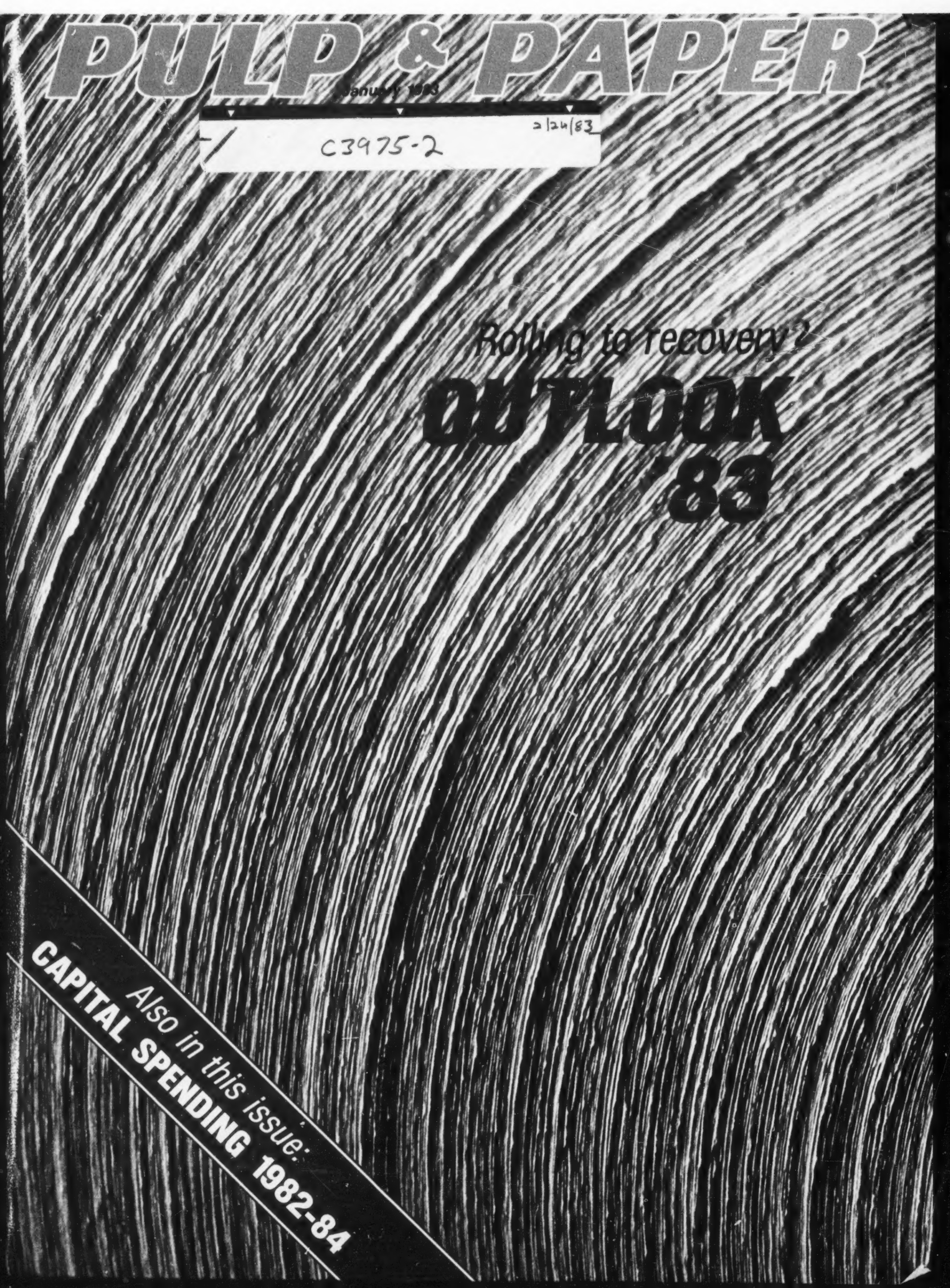

Rolling to recovery?

OUTLOOK '83

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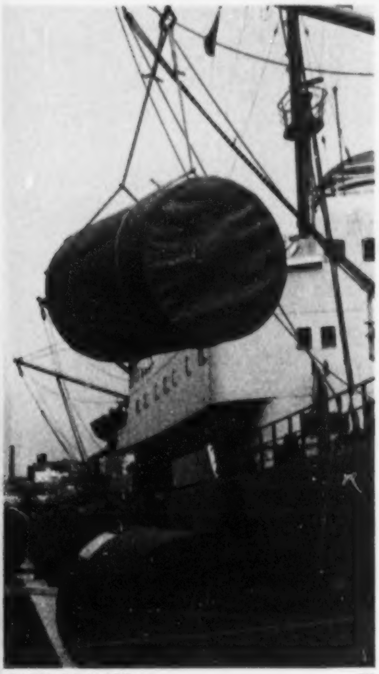

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***COVER:** Side view of a roll of pulp (photo courtesy M.R. Castagane).*

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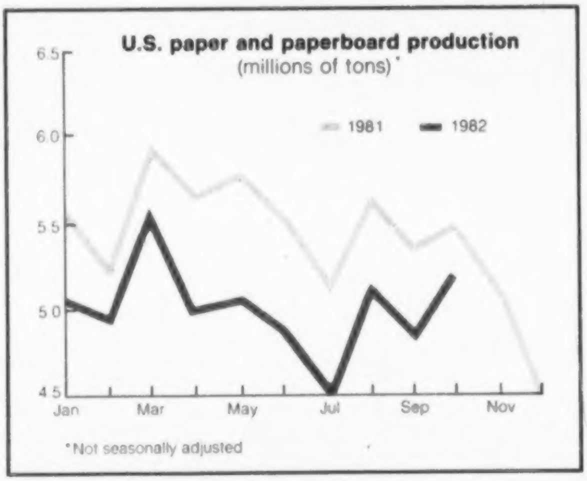
MONTH IN STATISTICS

U.S. paper and paperboard production in October totaled 5.2 million short tons, 2.3% below the October 1981 total, according to the American Paper Institute. The production trend, as measured by the two-month moving average of the seasonally adjusted data, was 60.9 million tpy, about 0.3% above the September trend level and 5.8% above the low reached in the May-June period. However, total output for the first ten months of the year was 5.2% below year ago.

Among major grades, newsprint production rose in October, bringing the ten-month rate to 5.1 million tpy. But printing/writing paper grades showed the strongest production trends, with coated paper 1.3% ahead of its year-ago level. Paperboard grades show similar trends. The ten-month data put total output down 7.4%, with containerboard output for domestic use down 8.6% and boxboard output for domestic use down 7.2%.

Total Canadian newsprint shipments in October came to 685,000 metric tons, down 13.8% from October 1981, according to the Canadian Pulp & Paper Assn. Newsprint mill operating rates rose to 76% from 60% in September, but were well below the 96% rate of a year earlier.



		Latest month (000 short tons)	% change from year ago	Annualized year-to-date (000 short tons)	% change from year ago
PAPER & PAPERBOARD PRODUCTION[1]					
Newsprint	October	448	−3.2	5,120	−2.8
Uncoated groundwood (s)	October	138	2.2	1,448	−1.8
Coated paper (s)	October	451	2.7	5,045	1.3
Uncoated free sheet (s)	October	674	−1.7	7,865	−2.1
Unbleached kraft packaging and industrial (s)	October	315	1.9	3,667	−6.7
Tissue	October	380	−3.1	4,409	‡−3.0
Total paper	**October**	**2,654**	**−1.3**	**30,503**	**−2.8**
Kraft linerboard, unbleached	October	1,191	−1.9	13,762	−7.9
Semichemical medium	October	378	−5.0	4,419	−8.6
Bleached paperboard	October	305	−5.3	3,736	−6.5
Recycled paperboard	October	579	−2.7	6,706	−6.8
Total paperboard	**October**	**2,539**	**−3.2**	**29,689**	**−7.4**
Total paper and paperboard*	**October**	**5,193**	**−2.3**	**60,203**	**−5.2**
PULP, WASTEPAPER & FIBER[2]					
Total woodpulp production	September	3,841	−10.8	49,865	−5.7
Market pulp production	September	431	−9.8	5,787	−7.5
Wastepaper consumption at paper/board mills	September	1,122	−7.2	13,722	−3.7
Pulpwood consumption (cords)	October	6,601	−0.7	79,345	−1.8
CONVERTED PRODUCTS STATISTICS[3]					
Corrugated box shipments (billion ft^2)	October	21.064	−4.5	198.335†	−5.6
Containerboard inventories at box plants	Oct. 1	2,394	−2.1		
INTERNATIONAL TRADE[2]					
U.S. paper imports (including products)	September	657	6.3	7,941	−3.6
Imports of Canadian newsprint	September	484	−5.7	6,450†	−5.4
U.S. paper exports (including products)	September	379	5.3	4,294	−11.1
Exports of unbleached kraft linerboard	October	149	14.6	1,909	−1.4
Exports of woodpulp	September	298	−14.1	3,501	−6.9
CANADIAN STATISTICS[4] (reported in metric tons)					
Total newsprint shipments	October	685	−13.8	6,637†	−9.6
Operating rates	October	79%	97%	83%	94%
Inventories held by U.S. consumers	Oct. 31	1,358	−8.3		
Woodpulp shipments (export only)	October	397	−30.8	4,810†	−13.2
Operating rates	October	76%	96%	77%	87%

1. American Paper Institute. 2. API, Bureau of Census, American Pulpwood Assn. 3. Fiber Box Assn., Paperboard Packaging Council. 4. Canadian Pulp & Paper Assn.
*Includes construction and wet machine grades. †Not annualized. ‡Not directly comparable to year ago because of coding change. (s) = shipments.

TARIFFS

EC lifts duty on Swedish exports

In reaction to Sweden's 16% currency devaluation in October, the EEC Commission in November raised the duty on Sweden's exports of major printing/writing grades from an average of 4% to 10.9%, effective Nov. 13. Newsprint was not affected. EEC Commission officials claim Swedish printing/writing export ceilings to the European Economic Community have been reached.

The Commission reached its decision after EEC paper producers, who feared unfair competition from Swedish suppliers, lobbied for action. The increase was to be reviewed at year-end. Under existing agreements, tariffs are due to fall to 2% in 1983 and be phased out by the end of the year.

Sources say that since the tariff rise was only for seven weeks, its effect would be minimal. However, the new duty, together with a new 20% company dividend tax in 1983, is expected to hurt profitability in Sweden.

Tariff conflict on liner settled

Problems that U.S. kraft linerboard producers have encountered with Belgian customs officials have been eliminated by a new European Economic Community regulation. The new law, which took effect Nov. 4, allows high-yield kraft linerboard that contains more lignin than liner made in other chemical pulping processes to still be classified as a kraft product under EC tariff subheading 48.01 C II, "other kraft paper and kraft board."

Belgian officials were charging higher tariffs for liner made by the high-yield pulping process, claiming too much lignin remained in the fibers for the product to be considered true kraft linerboard, said a U.S. official.

The EC reached its decision after taking a poll of all its member states, and the consensus was that the quantity of lignin remaining in high-yield kraft linerboard was "not of great importance" allowing for classification as "other kraft paper and board" rather than "other paper and paperboard," according to the EC's mandate. Belgium subsequently agreed to accept the decision, said the official.

Another dispute involving EC's definition of kraft paper and board is still not resolved, however. U.S. officials are awaiting authorization from Congress to resume talks on the problem, which involves EC's requiring all kraft paper/board to contain at least 80% softwood. This excludes products such as bleached board and saturating kraft, as well as some linerboard, and groups them in a higher tariff classification.

MACHINERY

No growth seen for machine imports

Imports of pulp- and papermaking and converting machinery into the U.S. have remained relatively steady as a percentage of total purchases of such equipment over the past five years, according to a recent report by the U.S. International Trade Commission.

U.S. paper machinery shipments, exports, imports
(millions of $)

	1981	1980	1979	1978	1977
Producer shipments	$1325e	$1177	$1017	$799	$698
Exports	341	311	226	187	181
Imports	254	232	237	180	150
Apparent consumption	1237	1098	1028	792	668
Ratio imports/ consumption	20.5%	21.2%	23.0%	22.7%	22.5%

U.S. machinery imports/exports by most important countries of origin and destination
(000 tons)

Imports	1981	1980	1977
Finland	$76,598	$43,626	$23,443
W. Germany	56,581	66,486	49,268
Canada	25,305	34,150	12,646
Switzerland	21,769	19,067	20,135
Sweden	17,497	20,240	15,671
Japan	16,567	10,682	6,096
Italy	13,063	5,518	2,119
Exports			
Canada	80,658	62,928	44,650
Mexico	39,042	44,407	23,421
W. Germany	18,726	31,604	8,318
United Kingdom	18,212	13,527	6,622
Venezuela	14,261	12,350	9,450

e = estimated.
Source: U.S. International Trade Commission.

Paper machinery imports have risen from $150 million in 1977 to $254 million in 1981, but total U.S. purchases of such equipment have risen by a comparable amount so that the ratio of imports to total purchases has fluctuated between 20.5% and 23.0% during the five-year period, according to the ITC's *Summary of Trade & Tariff Information*.

Largest exporters of paper machinery to the U.S. in 1981 were Finland, Fed. Rep. of Germany, Canada, and Switzerland (see table). Finland was by far the largest exporter of primary pulp- and papermaking equipment to the U.S., with 1981 sales of $66.0 million, nearly triple the 1977 level of $23 million. Fed. Rep. of Germany was the largest exporter of pulp- and paper-finishing equipment with 1981 sales of $44.0 million. Switzerland led in paperboard converting equipment with shipments to the U.S. of $17.0 million in 1981.

U.S. exports of paper machinery nearly doubled from their 1977 level of $181 million to $341 million in 1981. Major export markets for U.S. machinery in 1981 were Canada at $80.7 million, Mexico at $39.0 million, and several of the larger European countries.

The ITC report shows U.S. tariffs on pulp and paper machinery and parts have declined from 3.5% in 1979 prior to multilateral tariff reductions to 2.2% this year and are scheduled to become duty-free in 1987. Selected tariffs for Canada, Mexico, and the EC show that in general U.S. equipment faces higher tariffs in these countries. For example, the EC tariff on paper machinery will drop from 4.6% in 1982 but remain at 3.8% even after tariff reductions take full effect.

Newsprint:

Operating rates fall as recession reduced consumption

Statistics:	**1981**	**1982**	**1983e**
UNITED STATES			
Production, 000 short tons	5065	5120	5139
Capacity, 000 tons	5334	5583	5710
Utilization rate, %	95	92	90
Apparent U.S. consumption			
000 tons	11,175	11,100	11,488
lb/capita	97.2	95.8	92.3
000 tons/$ billion real GNP	7.41	7.51	7.59
CANADA			
Production, 000 short tons	9650	9075	9235
Capacity, 000 tons	10,411	11,045	11,246
Utilization rate, %	93	82	82

e = estimate

Grade structure: Newspapers consume most of the newsprint made. Smaller factors in the market include advertising supplements, government publications, comic books, and commercial printing. Most newsprint is printed on letterpress machines, although offset printing has captured more than one-quarter of all U.S. consumption in recent years. The standard basis weight for newsprint remains 30 lb/3000 ft², up from the previous standard of 32 lb. common before 1974. Some newsprint 28.5 lb and lower is also made.

Production/capacity: A prolonged recession in the U.S. caused newsprint demand, particularly for Canadian paper, to fall off considerably in 1982, with mills there operating at 82% of capacity while U.S. mills ran at 92%. Canadian mills took a substantial amount of downtime and production dropped 6% to 9.075 million short tons compared to 9.650 million tons in 1981 while U.S. production remained relatively flat, increasing just 1% to 5.120 million tons from 5.065 million tons a year earlier.

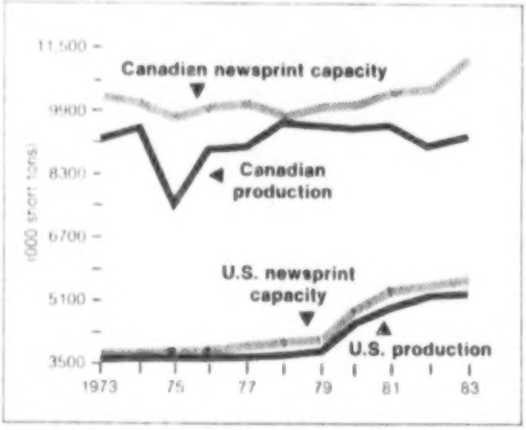
Canadian newsprint capacity jumped about 955,000 tons in 1982 from 1981, with new machines at British Columbia Forest Products Ltd. at Crofton, B.C.; Crown Zellerbach Canada Ltd. at Campbell River, B.C; Donohue Normick at Amos, Que.; and two machines at Ontario Paper Co. at Thorold, Ont.

The newsprint glut from overcapacity and falling demand resulted in a buildup of publisher inventories to 62 days of supply by the end of June. Stocks were cut to 48 days by end September, bringing levels toward the 40-day mark of a year ago.

Outlook: U.S. consumption in 1982 was off 0.7% to 11.1 million short tons from 11.175 million tons in 1981, but is expected to rise 2% to 4% in 1983. During the first quarter, publishers are expected to continue reducing stocks. And, with no strikes anticipated in British Columbia next year, inventories should remain low and increase only slightly as the economy improves.

U.S. capacity will be up 2.3% in 1983, with the biggest addition being 226,000-tpy Augusta Newsprint Co.'s mill in Augusta, Ga. Canadian capacity is expected to increase 4.5%, but that would change if several newsprint machines amounting to about 300,000 tons, now idled indefinitely, are shut down permanently. Operating rates for the U.S. and Canada should remain low next year, with Canada taking most of the downtime.

Pricing: Prices dropped $28/short ton to $425 on Nov. 1, 1981, effectively rolling back the mid-1981 price increase.



Estimated annual capacities of top companies are:

Annual capacity (000 short tons)

	Canada	**U.S.**	**Total**	**Capacity share (%)**
1. Abitibi-Price Inc.	1952	238[1]	2190	13.1
2. Bowater Inc.	577	878[2]	1455	8.7
3. CIP Inc.[3]	1133	—	1133	6.8
4. Consolidated-Bathurst	1050[4]	—	1050	6.3
5. MacMillan Bloedel	990	—	990	5.9
6. St. Regis Paper Co.	—	850[5]	850	5.1
7. Boise Cascade	249	461[6]	710	4.3
8. Ontario Paper	710	—	710	4.3
9. Kimberly-Clark	350[7]	339	689	4.1
10. Publishers Paper	—	575	575	3.4
11. Crown Zellerbach	430[8]	140	570	3.4
12. Kruger Inc.	526	—	526	3.2
13. B.C. Forest Products	480	—	480	2.9

1. Includes 77,000 tpy from Boise Southern, DeRidder, La.; balance assigned to Boise Cascade.
2. Includes 226,000 tons from Catawba Newsprint (51% owned); also 653,000 tons from Calhoun, Tenn.
3. Subsidiary of Canadian Pacific Enterprises Ltd.
4. Excludes No. 3 paper machine at Wayagamack div. mill, shut down indefinitely in 1982.
5. Southland div.
6. Includes 278,000 tons at Boise Southern Co.; balance of tonnage assigned to Abitibi-Price.
7. Includes production at Spruce Falls Power & Paper Co. (50.5% owned).
8. Canadian capacity being sold to Tasman Pulp & Paper of New Zealand, pending regulatory approvals.

North American capacity (1982): **16.683 million tons**
Capacity share of top five companies: 40.5%
Capacity share of top ten companies: 62.0%

Price history is as follows: (U.S. East contract): 1970, $152; 1971, $158; 1972, $165; 1973, $170; 1974, $235 (30-lb); 1975, $260; 1976, $285; 1977, $305; 1978, $345; 1979, $375; 1980, $426; 1981, $453; 1982, $425.

Markets: U.S. newspapers bought 56% of their newsprint from Canada in 1982, down from 59.6% in 1981 and 60.6% in 1980. Expanding U.S. capacity should continue this trend, with Canadian newsprint producers expected to supply only 55% to 56% of U.S. newsprint in 1983, down from 66% just five years earlier.

OUTLOOK '83

U.S. pulp/paper industry expected to begin road to recovery in '83

Moderate recovery seen lifting industry from deep slump caused by two recessions, excess capacity—but will strong price/profit rebound wait until '84?

SPECIAL PULP & PAPER REPORT

■ The U.S. paper industry should be on road to recovery in 1983, although some industry executives and analysts believe it may not be until late in the year or 1984 until prices and profits begin to rebound strongly.

While two back-to-back recessions have caused industry production to stagnate since 1979, capacity has continued to grow over that period at a roughly 2.5%/year rate. Estimated U.S. paper and paperboard production (excluding construction grades) of 59.7 million short tons in 1982 was down about 4.1% from 1981 and 2.6% from its level in 1979. But companies found it difficult to quickly turn off the capital spending spigot in the face of worsening market conditions once major expansion projects were already underway.

EXCESS CAPACITY. The result has been a sharp decline in U.S. paper industry operating rates from nearly 95% at the peak of the last industry cycle in 1979 to around 85% or 86% in 1982. Overcapacity combined with pressure on key export grades in overseas markets caused widespread price discounting which severely squeezed profit margins. With red ink from many wood products operations, the paper industry in 1982 experienced something like a 40% to 50% profit drop—worse than the 1974-75 recession in which paper production dropped more sharply.

"Overall, business conditions in 1982 were terrible, but near the end of the year, demand for some of the industry's products was beginning to show improvement," according to Dr. Edwin A. Gee, chairman and CEO of International Paper Co. A similar view was expressed by Steven C. Mason, president and chief operating officer of Mead Corp., who called 1982 a "disastrous year for the forest products industry," describing its greatest disappointment as the "continuing and increasing weakness in prices." His current assessment is that "we are now bumping along at the bottom" with some very mixed signals from different commodities and products."

MODERATE RECOVERY. Both IP and Mead look for about a 3% increase in real GNP in 1983—a very moderate rise for the first year of an economic recovery—after a 1.5% decline during the past year. "A large part of this increase will be accounted for by higher consumer spending and a corresponding rebound in industrial production," said Gee. "We expect interest rates to be lower in 1983, with the prime rate projected to drop further, and inflation to stay in the moderate range of about 6%."

Norma Pace, senior vice president of the American Paper Institute, looks for a 3.5% advance in real GNP, a 6.5% rise in industrial production and a decline in the prime rate to about 10% in the first half, with a slight uptick in interest rates in the second half. "The best way to get the recovery moving is to lower interest rates and I think the Federal Reserve has shifted its policy, after holding monetary reins too tight in 1982."

Her biggest fear is that "demagoguery over the budget deficit is going to delay the recovery by putting an expectation factor on interest rates that really shouldn't be there." Added Richard B. Madden, chairman and CEO, Potlatch Corp.: "The recovery could end just as quickly as it begins if interest rates go back up again, which is exactly what happened in 1980," With the fiscal 1983 federal budget deficit projected by some economists to run from $170 to $180 million, he feels that not enough is being done to curtail government spending. "The thorny issues relative to social security and defense (spending) must be addressed."

IMPROVING PRODUCTION. Most industry executives and analysts expect paper and paperboard production to show only a moderate recovery next year in line with the economy. IP's Gee looks for 3% to 4% growth in volume with operating rates improving by around 2%, "so while there will be growth, there is no way that it could be described as vigorous." Mason of Mead expects the recovery to be gradual, without much momentum before the second half.

"1983 won't be a great year for forest products, but it should represent a substantial improvement over 1982."

Outlook '83 was prepared by P&P's news staff consisting of Will Mies, Dave Allan, Paula Irons, and Debra Adams.

Rolling to recovery?

Data Resources Inc., a leading economic forecasting firm, expects U.S. paper and paperboard production to increase 5.2% in 1983 to 62.9 million tons but this is expected to result in an average operating rate of only 89% in 1983 due to further increases in capacity. Security analysts with leading Wall Street investment firms on average look for 4.8% increase in production and operating rates of about 89% for paper and 88% for paperboard this year.

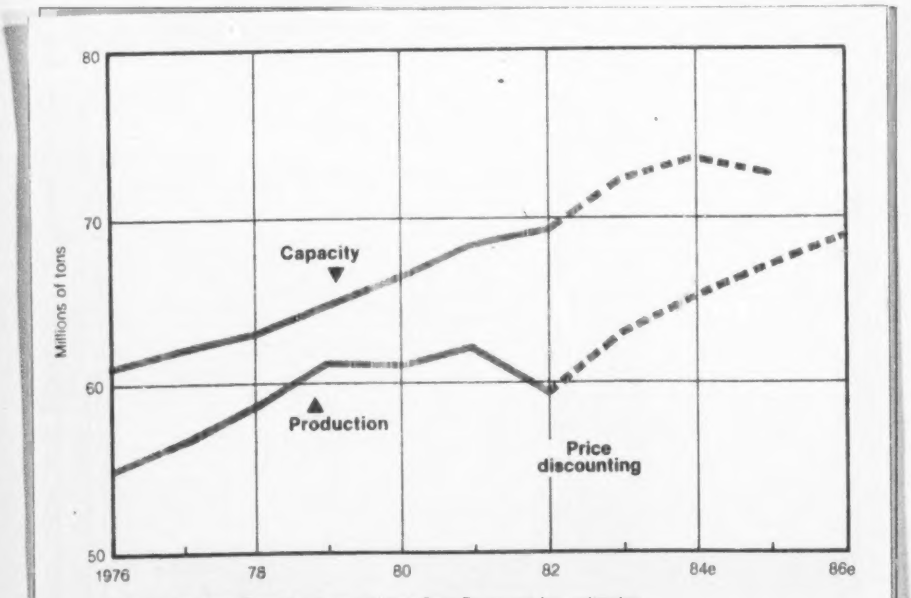
Not much lift is expected from export markets either, which most industry observers expect will come back even slower than the domestic economy. "The combination of a strong U.S. dollar and the Swedish devaluation in 1982 had a strong impact on pricing and demand for export commodities and this will carry over into 1983," Mason commented. "With overseas economic growth expected to be about 2%, and with the dollar likely to continue to be relatively high, 1983 will be a year of slow growth in export markets," said Gee.

PRICING UNCERTAIN. What worries some analysts is that the modest economic recovery projected for next year may not pull industry operating rates far enough out of their deep slump to enable companies to raise prices very much next year. "Operating rates in 1982 will range between 83% to 86% and, if our economic forecasts are about right for 1983, will be little changed this year," commented Lawrence A. Ross, an analyst with Paine Webber Mitchell Hutchins Inc., who expects 1983 price levels to remain unchanged to up 2% "at best."

Most analysts are more optimistic and on average look for a 4.1% increase in industry price levels this year after about a 2% to 3% decline last year year. One factor that causes some analysts to be more upbeat about industry operating levels in 1983 is the large number of capacity shutdowns being caused the the recession. Bruce Kirk, of Goldman Sachs, estimated financial pressures will have caused 1.9 million tons of industry capacity to have shut down by the end of 1982, with another, more normal 800,000 tons closing in 1983.

MODERATION IN COSTS. Costs are rising at a slower rate than before the recession and this is also causing some optimism about 1983. "Oil costs are lower, wage increases are no longer double digit, raw material and chemical costs have been at least stable and, in many instances lower," John R. Kennedy Jr., president and CEO of Federal Paper Board Co. Inc., said recently.

And Mark S. Rogers, an analyst with Dean Witter Reynolds, noted: "The industry's three most important variable costs—fiber, labor, and energy—are on average increasing at rates more than 50% below those which were common through the 1970s." On average, analysts look for about a 3% increase in costs per unit of output in 1983—about the same level of increase as in 1982.



Source: American Paper Institute statistics; Data Resources Inc. estimates

U.S. PAPER AND PAPERBOARD TRENDS, 1976-86

Production and capacity

WHAT ANALYSTS ARE PROJECTING FOR 1983

Percentage change from 1982 levels

	Growth in real GNP	Paper/board production[1]	Operating rates[2] Paper	Operating rates[2] Paperboard	Prices paper/board	Costs per unit output	Operating profits[3] Paper	Operating profits[3] Forest Prod.
Rodney Young/J. Wilson Data Resources	+3.0%	+5.2%	90.0%	88.0%	+4.1%	+5.6%	n.a.	n.a.
Mark S. Rogers Dean Witter	+3.8	+5.1	89.4	87.8	+9.4	+6.1	+66%	+216%
Mary K. Fraser Donaldson, Lufkin	+3.7	+6.0	88.0	88.0	0.0	+2.5	−15	+500
Bruce Kirk Goldman Sachs	+3.0	+6.0	—90.9—		n.a.	+1.0	+30 to +60	n.m.[3]
Chad E. Brown Kidder Peabody	+2.4	+5.0	91.0	90.0	+5.0	+1.0	+50	n.m.[3]
Clarence W. Brown Lehman Brothers	+4.0	+5.0	90.0	89.0	+6.0	+5.0	+40	+100
Thomas P. Clephane Morgan Stanley	+3.0	+4.2	88.2	85.7	+3.0	+1.8	+37	+346
Gary Palmero Oppenheimer	+2.8	+5.5	89.5	90.0	+4.0	+4.5	+15	+300 to +500
Lawrence Ross Paine Webber	+1.9	+1 to +2	86.0	84.0	0 to +2	+1 to +2	Flat to down	n.m.[3]
George Adler Smith Barney	+2.4	n.a.	89.5	87.5	+4.0	+3.0	+15	n.m.[3]
Average	+3.0	+4.8	89.3	88.1	+4.1	+3.2	+28.1	+312.4[3]

1. Excludes construction and wet machine grades in most cases.
2. Production as percent of capacity.
3. After-tax profit excluding extraordinary or nonrecurring items. Earnings for paper companies generally include some contribution from wood products, while forest products profits derive partly from paper operations. Percentage profit increases for forest products firms not meaningful in many cases since a loss or close to breakeven profit was estimated for 1982.

Profit projections for the paper industry this year vary widely, with some analysts looking for flat to declining earnings, while others look for increases of 50% to 60%. One factor that will help most companies is that nearly all are partly integrated into the wood products business, which is expected to go from a loss position in 1982 to a level of moderate profitability this year. Earnings of forest products companies that derive the largest share of their sales from lumber, plywood, and other wood products should rise dramatically.

CAPITAL SPENDING WEAK. Capital spending, however, will probably not revive significantly this year because of the need for companies shore up their balance sheets. Donald P. Brennan, head of Morgan Stanley's new forest products investment unit, noted that many companies in the industry are "pretty close to the wall and pressing the limits of what would be considered prudent debt."

Kenneth E. Lowe, director of newly formed Communication & Information Services, said "there is no way the paper industy can maintain capital spending at the plus-$6-billion level without substantially increasing long-term debt and reducing dividends—and that would be unpalatable to most companies." Thus he projects U.S. paper industry capital spending will decline by nearly 5% in 1983 from a base of $5.9 billion in 1982.

This assessment tends to be supported by PULP & PAPER's annual capital spending survey, which shows outlays over the three-year period 1982-84 declining by nearly 8% from their 1981-83 level reported in last year's survey (see p. 79). Data Resources projects industry capacity will only grow about 1.4% in 1983, 1.0% in 1984, and 1.1% in 1985 before beginning to pick up in 1986-87.

LONGER-RUN OUTLOOK. But slowing capacity growth will lay the groundwork for the eventual resurgence of paper industry operating rates and profitability in mid-decade. DRI projects paper and paperboard production will rise by 5.2% from 59.8 million tons last year to 62.9 million tons in 1983 with a further increase of 4.1% in 1984, 2.4% in 1985, and 2.3% in 1986 to a peak of 68.6 million tons in the next cycle. Because of lower capacity growth, paperboard grades will have the highest operating rates at the 1986 peak—99% for solid bleached board and 97% for unbleached kraft linerboard, while domestic newsprint will also enjoy a 97% rate and uncoated free sheet is at 95%, according to DRI's Rodney L. Young.

Market pulp is also expected to be very tight at the peak of the next cycle, with combined operating rates for North American and Scandinavian producers hitting 95% and those for U.S. mills reaching 99%. The price of northern softwood bleached kraft is expected to soar to a level of $930/metric ton by 1987 from its current depressed level of around $420/ton.

OPTIMISM ABOUT HOUSING. The longer-run outlook for the wood products side of the industry is also reasonably bright, although few observers expect the boom years of the late 1970s to return. Young said that DRI projects "fairly good recovery" in housing starts, with the number of units rising to 1.39 million in 1983, 1.68 million in 1984, and 1.80 million in 1985.

International Paper expects housing starts to average 1.6 million units between 1983 and 1987, although Gee noted that "houses built during this period will most likely be smaller than houses built in recent years. "Consequently, less lumber and plywood will be consumed per new housing unit, so the growth rate in consumption should be about 2% annually after 1983."

UNCOATED FREE-SHEET

Long-delayed rebound

Twelve months after paper industry analysts predicted an upturn in uncoated free-sheet demand by mid-1982, industry observers still feel a rebound is imminent. But most now caution that any change from current shipment levels will roughly match changes in U.S. real GNP. A consensus sees demand for uncoated free-sheet in 1983 improving by 2.5% to 3.5% over 1982 levels—assuming the GNP grows by about the same amount.

Signs of a quickening in demand were showing up in various ways throughout the second half of 1982. Shipments of xerographic paper bottomed out in December 1981, and then from March 1982 on they exceeded year-earlier performances. Shipments of most other major grades of uncoated free-sheet were turning up by the fall from dismal first-half levels, although they still lag well behind 1980's record. Indeed, most observers predict total uncoated free-sheet shipments will rise about 3.5%, to 8.1 million tons, only 100,000 tons or so above 1980's performance.

Mead Paper's Austin Lance, manager-market research for the fine paper division, says this kind of growth rate will push operating rates up to between 89% and 91%, an improvement over the 87% rate that one executive estimated was typical for the industry in the fall of 1982.

Poor operating rates have not been the only problem facing the industry: pricing weakened across the board in uncoated free-sheet, and in commodity areas like offset printing papers it virtually collapsed. Price weakness really began in 1981 and snowballed during 1982, creating a momentum that may take fairly high operating rates to reverse—especially with market pulp prices likely to remain soft, acting as a brake on paper price increases.

While pricing may be slow to recover, most observers think demand for several grades of uncoated free-sheet will grow considerably faster than the economy as a whole. One executive predicted forms bond shipments will rise by 5% to 5.5% in 1983, with carbonless forms paper basestock shooting up at a 6% to 7% pace and the bond/mimeo/duplicating/xerographic group going up by 5.5% to 6%. A Champion International spokesman noted that some inventory rebuilding should aid shipments, although Mead's Lance noted that mill inventories are currently high.

Some executives doubt the big publishing sector of uncoated free-sheet will match the shipment growth of the business papers group, however. Lance predicts that "offset book papers will be less vigorous, achieving only a 4% increase in 1983 and averaging 4% annual growth rate over the next several years." But Union Camp Corp.'s Robert Sasser, general sales manager for bleached paper and board, expects offset paper demand to grow by 5% to 5.5% in 1983. He is less bullish on the remaining uncoated free-sheet grades, however, estimating envelope papers will see demand rise by 2% to 2.5%, tablet will be "flat to a decline of 2%," and other grades including cover and text, papeterie, and miscellaneous papers will be "flat to up slightly."

One problem uncoated free-sheet mills may increasingly have to cope with this year is competition from coated groundwood mills suffering from overcapacity in their industry. Some will respond by producing uncoated paper just to keep machines running. But Union Camp's Sasser noted there is little chance for coated groundwood to penetrate traditional uncoated markets such as cut-size paper or forms bond, adding that "the issue seems to be whether the natural coated groundwood markets (magazines, mass market catalogs) will grow in pace with capacity."

Beyond 1983, some observers see problems developing for the industry as several new machines come on-line through the mid-decade (see table). That will create potential headaches for many existing mills. About 21% of uncoated free-sheet capacity is located in nonintegrated mills, relying on purchased pulp, and many of those mills are small and hampered by high operating costs in addition to pulp-purchasing expenses.

Union Camp's Sasser thinks a restructuring of the industry could take place in the next few years, as new capacity forces "medium-efficiency" mills away from commodity grades and toward specialties, freezing out some of today's small, relatively inefficient mills.

Mead's Lance pointed out that "announced capacity increases over the next three years average 2.7%," and "that's not a great deal of tonnage to absorb if we continue to move out of the recession." A Champion spokesman predicted that "the new capacity will come on-stream as the markets firm. This incremental tonnage will be absorbed readily in the expanding market."

Some new capacity announcements may still be made in the next year or two, another executive noted; but he speculated capital spending seems more likely to focus on modernizing existing mills than adding new machines.

MAJOR NORTH AMERICAN PRINTING/WRITNG PAPER CAPACITY CHANGES

Project	Location	Capacity (000 tons)	Startup
Coated free-sheet (Nos. 1 to 3)			
Consolidated	Wisconsin Rapids, Wis.	n.a.	1983
Scott Paper	Skowhegan, Maine	200	1983
Scott Paper	Muskegon, Mich.	n.a.	1983
Consolidated[r]	Stevens Pt., Wis.	11	1984
Champion[1]	Quinnesec, Mich.	n.a.	n.a.
Westvaco[1]	Luke, Md. or Wickliffe, Ky.	150	n.a.
Coated groundwood (Nos. 4 and 5)			
Pentair/Niagara[r]	Niagara, Wis.	15	1983
Pentair/Niagara[r]	Niagara, Wis.	15	1984
Blandin Paper[1]	Grand Rapids, Mich.	177	n.a.
Nitec[1,2,r]	Niagara Falls, N.Y.	55	n.a.
Weyerhaeuser[1]	Columbus, Miss.	n.a.	n.a.
Uncoated free sheet			
Champion	Courtland, Ala.	145	1983
Great Lakes	Dryden, Ont.	59[3]	1983
Great Northern	Nekoosa, Wis.	n.a.	1983
Crown Zellerbach	Camas, Wash.	160	1984
International Paper[r]	Georgetown, S.C.	120	1984
Pentair/Flambeau[r]	Park Falls, Wis.	18	1984
Union Camp	Eastover, S.C.	210	1984
James River[r]	Gorham, N.H.	25	1986
Boise Cascade[1]	International Falls, Minn.	n.a.	n.a.
Champion[1]	Quinnesec, Mich.	n.a.	n.a.
Champion[1]	Halifax, N.C.	n.a.	n.a.
Domtar[1]	Windsor, Que.	n.a.	n.a.
Georgia-Pacific[1]	Port Hudson, La.	138	n.a.
MacMillan Bloedel[1]	New Westminster, B.C.	83	n.a.
Makin Project Ltd.[1]	Red Deer, Alta.	48	n.a.
Weyerhaeuser Co.[1]	Columbus, Miss.	200	n.a.

n.a.=not available. r=rebuild or modernization.

1. Under consideration or rumored
2. Nitec mill is shut down indefinitely, in course of Chap. XI reorganization; modernization plan announced before shutdown.
3. Net increase from installation of one new 135,000-tpy machine replacing three existing units.

COATED PAPER

Overcapacity hangover grows

Coated paper mills will sell more paper this year than last, increasing production levels at a faster pace than the growth rate in the U.S. economy. But with coated groundwood capacity available far in excess of even the most optimistic demand projections, operating rates for groundwood mills will actually fall slightly in 1983. Coated free-sheet mills won't improve their operating rates over an unimpressive 1982 performance either, suffering from competition with surplus coated groundwood plus a free-sheet capacity rise of 4.6% for the year, slightly above expected demand.

Overcapacity on the coated groundwood side is so severe that some observers expect significant shutdowns in the next few years, while others believe temporary shutdowns will continue through 1983 and even 1984.

A spokesman for Champion International Corp. predicted that "coated groundwood capacity will be absorbed in two to three years," and an executive with another company said it could take until as late as 1984. The Champion spokesman added that "export activity will determine this to some extent." Champion also points to catalogs and direct mail end-uses significantly outperforming book publishing end-uses and helping the industry to absorb the new capacity.

Mead Corp.'s Austin Lance, manager of market research for fine papers, believes that "coated groundwood will poach upon coated free-sheet in some areas, particularly in the No. 3 and 4 category." Lance expects the groundwood industry to respond with a combination of competitive pricing, extra downtime, and possibly machine shutdowns. All of that will make further market penetration by supercalendered uncoated groundwood difficult, he added.

Coated paper was already suffering from overcapacity as well as soft demand in 1982, and as Champion noted in releasing its third-quarter figures, "coated paper prices, while above those of a year ago, were below those of last quarter." On the other hand, Scott Paper's third-quarter report pointed out that "during the quarter, demand for coated printing paper, which had been soft earlier in the year, showed improvement."

A Champion spokesman predicted coated paper shipments in 1983 will be up 3.6% from 1982, reaching 5.2 million tons, while Mead's Lance thinks coated groundwood shipments could rise as much as 5% or 6%—in contrast with free-sheet, where he thinks shipments will grow by less than the 4.6% capacity increase scheduled for that grade in 1983.

If those levels are reached, operating rates should be at or slightly below present levels, and Lance puts free-sheet at 90% to 91%, while he estimates groundwood at 85% to 86%. Depressing the free-sheet and groundwood operating rates slightly, another marketing executive noted, could be the new 200,000-tpy Scott Paper free-sheet machine starting up in Skowhegan, Maine, in the first half of 1983. Granting that the Scott installation is a free-sheet machine, he noted that "we understand that the marketing plan is to try to insert tonnage into that market segment where the high-brightness groundwood grades, No. 4 grades, have been so successful."

Lance noted that "No. 1 coated through the first three quarters of 1982 has seen a 1.5% increase over last year. Nos. 2 and 3, on the other hand, have declined 5% to 6%. Recent moratorium and allocation announcements have been directed toward the higher coated grades. With coated free-sheet operating rates in the low 90s, the view from here is that any shortages this fall are temporary in nature. Once the economy really shows it's in a recovery pattern, commercial printing and other coated free-sheet end-uses will equal or slightly exceed the general economy."

TISSUE

Healthy growth ahead

Tissue mills enjoyed perhaps the best profit performance in the paper industry in 1982 despite sometimes hectic promotional discounting and an operating rate that Smith Barney, Harris Upham & Co. analyst George Adler estimated at just 86.6%. Most observers believe tissue mills will continue to outshine much of the industry in 1983.

This record, especially impressive in a serious recession, results as much from the nature of the product as from the management styles of the companies themselves. Tissue products in general are not considered to be discretionary items, and even where they are, they have other advantages that may prove decisive—as in the choice between paper diapers and cloth diapers, where families have tended to economize not by stocking up on the cloth alternative but by switching to a less expensive but still convenient private label paper diaper.

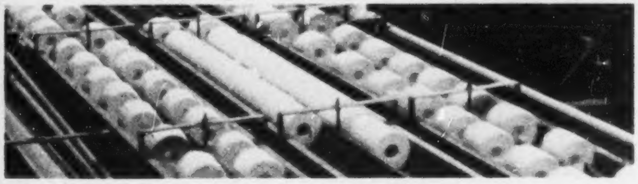
Some areas of the industry should do better than others, however. The industry as a whole, which Adler believes produced 3.5% less in 1982 than in 1981 on a tonnage basis, should see output rebound with a 3.2% growth rate this year. Shipment volume on a unit basis should be more rapid than that, "also aided by bathroom tissue such as in the case of Procter & Gamble's new price brand, Banner," according to Adler. Paper towels and facial tissue "are more sensitive to changes in the economy" and therefore "should see larger gains" than even bathroom tissue, he said, while shipments of disposable diapers should rise at 6% to 7% in 1983, up from 5% in 1982 and approaching the 7% growth rate of 1981.

The 1982 tonnage production figure makes the situation appear worse than it really was, Adler notes, since mill and warehouse inventories were worked down during the year, and thus tonnage shipments probably did not decline by as much as the production figures did. Also, "unit volume of the various tissue grades in the first half of 1982 increased by a small amount, particularly a reflection of a shift to single-ply products as well as lower sheet counts per roll and box," Adler added. James River Corp., reflecting the results of tissue operations newly acquired from American Can Co., said sanitary product demand during its quarter ended Oct. 24, 1982, "remained relatively steady."

Most of the tissue industry's products are tied for their growth to the increase in U.S. population, but in Canada—and more so in many other countries—tissue products have still not reached the market saturation level they have in the U.S., and are still growing faster than population. Facelle Co. Ltd. president Brian Blakely said he expects Canadian shipments to rise by 4% in 1983—four times the rate of increase of that country's population—from the 460,000-short ton level of 1982, which in turn was up 4% from 1981.

However, Blakely expected facial tissue to drop slightly in 1982 and remain flat in 1983, while bathroom tissue should grow at about 3% this year and paper towels by about 4.5%. He also believes napkin shipment growth rates will approximate population growth rates.

Slightly depressed operating rates have hurt pricing in several recent years, but Adler thinks the U.S. rate will rise to 88.2% in 1983 and to 91.9% in 1984, or within 1% of the historically strong 92.8% rate of 1979. "Favorable" operating rates should continue in the mid-1980s because capacity expansion will focus largely on incremental increases through machine improvements, Adler believes. Wisconsin Tissue's new 60,000-tpy tissue machine, which started up in December 1982, is the last new U.S. machine currently scheduled to start up, although Scott Paper Co.'s 54,000-tpy "high technology" Everett, Wash., machine—idled indefinitely in 1982 after only a few months in operation—could start up again, adding production to the exceptionally volatile West Coast market.



But with U.S. capacity largely flattening out, Adler expects tissue prices, which haven't gone up since Fall 1981, to rise in Spring 1983 while promotional discounting may ebb under the influence of higher operating rates.

Blakely sees Canada's operating rate rising as well, from 86% in 1982 to about 90% in 1983 despite startup in 1981 of a new 30,000-short-tpy Facelle machine and modernizations announced by Scott Canada for Crabtree and Lennoxville, Que. For 1984, Scott also announced a new 40,000-tpy tissue machine for New Westminster, B.C. As Blakely noted, "all announced additions are in wider, high-speed machines, which puts pressure on older, narrower and high-cost production machines still operating in Canada."

Wastepaper price softness had its negative side for the commercial and industrial (C&I) side of the industry in the U.S., giving some competitors a cost justification for slashing prices in 1982. Also, an increase in the number of competitors in that market because of vigorous growth in C&I tissue in recent years added capacity more rapidly in C&I than in consumer, at a time when established players such as Wisconsin Tissue were expanding. At the same time, C&I mills were suffering from economic facts of life such as a slowdown in office building construction, reduced vacation travel and increased hotel/motel vacancy rates and shutdowns of factories throughout North America—all of which depressed demand by as much as 10% in 1982, in the estimate of one mill executive.

CONTAINERBOARD

Flat capacity growth seen

The U.S. containerboard industry is mired in a serious depression, but most industry executives and analysts look for at least some moderate improvement in 1983 and even tighter market conditions in 1984 and beyond. This is partly due to improving demand—but also to the fact that dismal financial results have discouraged new capacity additions and are causing the closure of some marginal, high-cost facilities.

Most observers look for about a 4% to 5% improvement in corrugated container shipments in 1983, following about a 4% to 5% decline in 1982 that reflected the severe slump in U.S. industrial production. For example, Roger W. Stone, chairman and CEO of Stone Container Corp., looks for a 5% improvement in corrugated container shipments in 1983.

WEAK BOX SHIPMENTS. "Shipments to nondurables, food and fresh produce (customers) should continue to be healthy, but a really strong market will require the recovery of interest-sensitive sectors of the economy such as housing and automobiles," commented the containerboard marketing vice president of one major company. "Regional shifts should continue to favor the South and West."

Depressed domestic corrugated box demand, inventory reduction and a sharp drop in export shipments caused linerboard production in 1982 to drop about 7% to around 13.5 million tons. While linerboard production last year was not much higher than its level in 1978, capacity over this same period has been growing by more than 3%/year. This has caused linerboard operating rates to drop from a high of 98% in 1979 to around 86% in 1982. Semichemical medium has followed the same downtrend, although somewhat less dramatically.

Remaining high inventorylevels of containerboard at box plants and mills will probably mean a slower pickup for board production in 1983. Evadna S. Lynn, a Merrill Lynch analyst, estimates U.S. liner output will rise only 2.4% in 1983, resulting in an operating rate of 86%. Roger Stone, however, looks for a more than 5% rise, with export shipments exceeding domestic demand, resulting in a more than 90% operating rate. And the marketing vice-president of another major company estimates operating rates for both liner and medium will average 90% in 1983.

Containerboard inventories at box plants and mills dropped from 2.7 million tons at the beginning of 1982 to 2.4 million tons at Nov. 1, which is still high by historical standards. One industry executive expects inventories "to remain high through 1983, with year-end levels similar to 1982," and then decline relative to box plant consumption. Stone, however, said inventories could drop below 2 million tons by the final quarter of 1983.

PROFIT SQUEEZE. Slack market conditions have resulted in considerable pressure on prices since the fourth quarter of 1981. Rebating from the $300/ton list price for 42-lb liner swept through the industry last winter and then recurred again late last spring with effective prices by November deteriorating to $250/ton—and even lower after freight allowances and other discounts.

This brought prices essentially back to their level in 1979, with disastrous consequences on industry profit margins. "Profits last year were generally dismal throughout the industry, with many manufacturers showing losses," one company executive noted. "Profit margins will remain low in 1983 until prices improve." Analyst Lynn believes that even though margins on liner manufacturing will improve in 1983, integrated operations could show another decline due to increased box market competition.

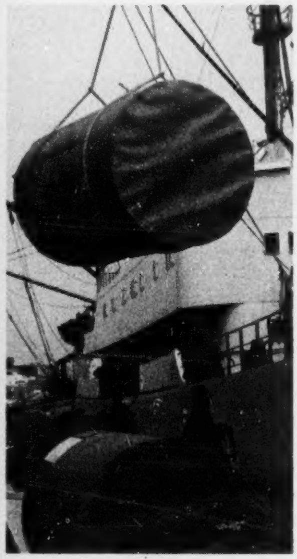
CAPACITY SHAKEOUT. The positive side of this gloomy picture is that most major containerboard capacity additions through 1984 have been postponed or cancelled, while some older, high-cost production facilities are being shut down. With the startup of MacMillan Bloedel's new 210,000-tpy medium machine at Pine Hill in December, not a single major producer has a new liner or medium machine scheduled to come on-line.

Meanwhile, International Paper Co. is phasing out

465,000-tpy of linerboard capacity at its Georgetown, S.C., mill as part of a program to convert the mili to more profitable bleached grades and recently shut down its older 215,000-tpy Bastrop, La., semichemical mill. Manville Forest Products has indefinitely idled a 106,000-tpy corrugating machine at its Manville, La., mill, and St. Regis Paper Co. is looking for a buyer for its money-losing 465,000-tpy Jacksonville, Fla., liner/kraft paper mill.

"As a result, there will probably be virtually no growth in capacity during 1982-84," according to Lynn. Incremental growth from several new machines as well as new technology (Beloit's new extended nip press which can increase machine capacity by 15% to 20%) will tend to be offset by some machine closures, she said. Excluded from this estimate, however, is any further shifting of kraft paper capacity to linerboard production because of plastic inroads into the packaging paper market—especially kraft grocery carryout sacks, which until recently have been relatively unscathed.

EXPORTS SLUMP. From a 1980 peak of 2.2 million short tons, export shipments of U.S. unbleached kraft liner dropped 20.5% in 1981 and declined about another 3% in 1982 due to the worldwide recession, the strengthening of the dollar in relation to most other currencies, and a dropoff of new orders from People's Rep. of China.



The continuing strength of the dollar and slow recovery of the European and Japanese economies would seem to indicate a fairly slow recovery for liner exports. "Exports for 1983 should be roughly at 1982 levels, strengthening at the end of the year as foreign economies recover," the marketing vice president commented. "The strongest demand growth should come from the Far East."

LONGER-RUN OUTLOOK. Thus, 1983 should put containerboard back on the road to recovery but real improvement in industry profitability may not come until 1984, when accelerating demand and flat industry capacity growth should cause operating rates to rise sharply.

Lynn projects 1984 operating rates for linerboard of 93.5%, while Rodney Young of Data Resources Inc. looks for a 94.5% rate. Gary Palmero, an analyst with Oppenheimer & Co. who estimates that as much as 400,000 to 800,000 tpy of industry capacity could be shut down by the end of 1984, looks for a 97% rate. This should enable producers to raise prices more rapidly, causing a substantial and much-needed rebound in profits.

BOXBOARD

Market shares shifting

Boxboard production dropped 8% in the first nine months of 1982 compared to the same period in 1981, with solid bleached sulfate paperboard off by 7% and recycled down 7.4%, according to American Paper Institute. Industry observers, however, said demand for clay-coated newsback, the largest recycled boxboard grade, held up better during 1982, causing SBS to lose some market share to newsback.

Some felt clay-coated should maintain its leadership position in the industry, while others said that any shifting to recycled from SBS over the last two years is due to a lagging economy and market shares should return to normal when business improves.

CLAY-COATED GAINS SHARE. Paperboard Packaging Council, which bases its figures on converting operations, reported clay-coated news accounted for 39% of total folding carton shipments in 1981 compared to 35.6% in 1980, while SBS's share dropped to 36% from 37.3%. Solid unbleached sulfate demand dropped 9.7% and SBS was down 4.5%, while clay-coated recycled was up 7.8%, despite a 6.7% drop in boxes made from other recycled paperboard. Some observers see this trend continuing in 1982.

U.S. Bureau of Census and API data for market shares in the folding carton industry, however, indicated SBS did not lose market share in 1981, and that solid bleached would continue to be the leading grade consumed by the boxboard industry in 1982. Census reported SBS held 37.5% of the total 3.4-million-ton folding boxboard market in 1981, while the industry's consumption of clay-coated newsback accounted for just 36% of the market. SBS and clay-coated unbleached kraft board (SUS) together comprised 50% of the 1981 market compared to 42% in 1972.

Any inroads made by clay-coated recycled boxboard probably reflected competitive pricing, greater recession resistance of markets traditionally served by recycled boxboard, and the desire of packagers to reduce costs during the recession. Recycled boxboard mills have been able to reduce prices because of the sharp drop in their wastepaper costs over the past couple years, but this advantage could be a temporary one if wastepaper prices begin to rise with an improvement in the economy in 1983.

PRICE GAP. Posted price for 20-pt clay-coated folding boxboard was maintained at $425/ton in late 1982, although considerable discounting was reported. SBS producers dropped prices on 16-pt and higher calipers of bleached boards to $590/ton in September 1982, essentially cancelling a July 1, 1981, price increase. And 16-pt coated SUS price was dropped $25/short ton in September to $475/ton.

While observers are uncertain if clay-coated or SBS will edge ahead in the market in 1983, they generally agree the lower grades of recycled paperboard are likely to continue to decline while clay-coated and SBS will expand into that market. Demand for clay-coated is expected to increase 3% to 4% in 1983, and show moderate growth over the next five to ten years if the price remains at least 11% below that of bleached board, according to one industry observer.

RECYCLED PROSPECTS. St. Regis Paper Co. president Edward J. McMahon said that clay-coated "turned the corner in 1981" and should continue to improve. Indicative of this trend is one converting firm which by the end of the first quarter of 1983 expects to be using 60% recycled and 40% of SBS in its operation, compared to a ratio of 57%/43% in the final quarter of 1982 and 50%/50% earlier last year.

If the economy recovers next year, SBS production might turn around, however, because items normally packaged in bleached boards, such as frozen foods and expensive toiletries, normally do better in a robust economy, observers indicate. Sid Pope, Federal Paper Board Co. treasurer, indicated, however, that it would take some time to work off high inventories of SBS, while recycled inventories should be normal at the beginning of 1983. ■

Newsprint, market pulp mills face year of slow recovery from slump

■ Canada's largest industry suffered a serious setback in 1982, enduring a combination of poor utilization rates, widespread red ink and loss of market share in important markets.

In some sectors of the paper industry, these losses will be recouped in 1983, but on the whole, Canadian mills in 1983 will find themselves producing at a level no higher than they experienced in 1978. And for genuinely healthy operating conditions, much of Canada's pulp and paper industry will have to wait until 1984 and beyond.

The industry's two biggest sectors, newsprint and market pulp, were probably hardest hit. Domtar Pulp & Paper Products Group president Roger Ashby predicted newsprint operating rates for Canada would average as low as 80% in 1982 and 83% in 1983, and he doesn't expect the country's market pulp operating rate to top its current 80% to 85% range until well into 1983, possibly as late as the fourth quarter. Jones Heward & Co. analyst Brian Topp thinks market pulp operating rates could average as low as 80% for the year.

The same general picture is true for other sectors of the Canadian industry. Shipments of coated groundwood dropped about 10% in 1982 and Ashby doesn't expect much improvement in 1983, with operating rates around 80%. Uncoated free-sheet demand in Canada should remain unchanged in 1983, he believes, although the operating rate for that sector could reach 85% "mainly through a somewhat stronger export effort."

That pattern of poor performances in 1982 and little or no rebound in 1983 is repeated in every sector of the Canadian economy. With British Columbia's forest products and mining industries especially hard hit by the recession, the Conference Board of Canada forecasts that unemployment in that province will top 14% in 1983. Quebec's unemployment rate will approach 16%, according to the research group.

And for Canada as a whole, with real gross domestic product (GDP) rising only 2.3% after a 4.8% drop in 1982, the Conference Board sees unemployment climbing to 12.7% from 10.9% last year. With 7.7% inflation and a double-digit prime rate on top of the expected unemployment numbers, economic conditions are sure to spawn calls for tougher government action against the recession, including anything from wage/price and currency controls to stimulative fiscal policy—confusing the business outlook even further.

Not all of the economic news will be bad this year, observers note. Pemberton Securities Ltd. analyst Jack Puusepp predicted that British Columbia paperworkers, the focus of the country's labor talks this year, "will be fortunate to get any wage increase in the new contract year beginning June 1983."

If he is right, that will be—for mill owners—a welcome change from recent double-digit settlements, including the 15%/13% contract mills were forced to sign in 1981. Moderation was already showing up in the eastern Canadian talks in mid-1982, when unions settled for wage hikes of 12% in the first year and 10% in the second, in contrast with a 17%/10% settlement in the previous contract.

Another sign of a changing attitude on the part of union members was the agreement of CIP Inc. box plant workers to accept a 10%/9%/7% pact in defiance of union leadership during a nearly industrywide strike.

But Canadian firms trying to sell overseas were dealt a serious blow in the fall of 1982 when Sweden and Finland pushed through major currency devaluations clearly—and successfully—designed to improve the competitiveness of their pulp and paper industries' exports. "In our opinion, the devaluation of the krona has rendered the coastal British Columbia mills less competitive," Puusepp notes. "Our estimates indicate that pulp from coastal mills in British Columbia will have a C$40/metric ton competitive cost disadvantage with Swedish pulp delivered to Rotterdam," he adds, indicating that interior British Columbia and southern U.S. mills do remain more competitive.

Puusepp feels Canada's dollar will remain around US$0.80 for most of 1983, protecting Canada's currency advantage for sales into the U.S. But Bowater Sales Corp. vice-president Wayne Mangels believes the Canadian dollar could rise as high as US$0.83 or US$0.85, which would hurt Canadian products in the U.S.

Clearly, the impact of such a trend on Canada's competitiveness in Europe would depend on what happens to Scandinavian currencies. Puusepp noted that "a further devaluation of European currencies, relative to the U.S. dollar, is not expected." He also pointed out that "Canada's experience with a devalued currency indicates that the benefits have been squandered away in the form of significantly higher wages. Similarly, we expect that the benefits of devalued Scandinavian currencies to their domestic economies will be temporary."

Canada's domestic fight against inflation also has a great deal to do with the future of its dollar, and thus of its export industries. The Conference Board's 1983 consumer price index forecast of a 7.7% increase is down from an 11% estimate for 1982, indicating some progress is being made.

On the other hand, the group is forecasting that "finance company 90-day rates" will drop only slightly from 1982, to 12.59% from 14.72%, leaving an actual increase in real interest rates from just under 4% to just under 5%. That is sure to fuel inflation and restrict economic recovery while it may attract some foreign money and boost the Canadian dollar, one analyst noted.

Other aspects of Canada's economic outlook are equally clouded. Domtar's Ashby pointed out that "opinion is still out on whether the federal government's 6% and 5% guidelines will be supported sufficiently well to bring these increases under control. The business community is giving strong support to the program and I wish we could say the same for labor, particularly the public sector unions. It's going to be a tough year."

Off year for market pulp mills

Strong dollars, devalued Swedish kronas and Finnish markkas, and a serious worldwide recession pushed the market pulp industry into a steep slide in 1982, and most observers believe it will take until 1984 for the industry to work itself completely out of the slump even if North American and European economies rebound strongly this year.

Operating rates for the Norscan region as a whole will average only 83.7% in 1983, up from 78.7% in 1982, according to Pemberton Securities Ltd. analyst Jack Puusepp. And Domtar Pulp & Paper Products Group president Roger Ashby thinks it could be as late as the fourth quarter of 1983 before the Canadian operating rate rises above its present range of 80% to 85%. Puusepp estimates Norscan production dropped 10.3% in 1982, and should recover by only 6.7% in 1983." Bowater's Mangels feels that demand worldwide will rise by 4% to 6% in 1983.

The impact of such low operating rates on pricing has been devastating. Northern bleached softwood kraft pulp delivered to Northern Europe—the industry's bellweather grade and destination—reached US$545/metric ton in 1981, and according to Jones Heward & Co. analyst Brian Topp, bottomed out in the fourth quarter of 1982 at $400 to $410. But Topp doubts it will rise as high as $520 before the fourth period of 1983 and doesn't think it will return to $545 before 1984. Smith Barney, Harris Upham & Co. analyst George Adler expects prices to start to recover slowly by the spring of 1983, returning to $545 within 12 months. Bowater Sales Corp. vice-president Wayne Mangels believes that prices should start up again by the second quarter of 1983.

Prices were already down and falling in the autumn of 1982 when the Swedes and Finns devalued their currencies by 16% and 10% respectively. After that, Scandinavian mills began cutting prices aggressively, and by year's end prices had reached the point in some areas where North American mills suffering under the burden of overvalued currencies were walking away from some business. MacMillan Bloedel Ltd. chairman Calvert C. Knudsen said Scandinavian mills were using the currency devaluation to put "tremendous pressure on European pulp prices, which could result in driving North America out of a substantial share of a traditional MacMillan Bloedel market."

BC Timber Ltd. president John Montgomery, in announcing in November 1982 the indefinite shutdown of his company's Prince Rupert, B.C., pulp mill, said the facility wouldn't start up again until markets improve—probably not before the second quarter at the earliest. "We are now operating in a fiercely competitive world pulp market where selling prices are at about the same level as they were in 1975. In the meantime, our total manufacturing costs (in British Columbia) for wood fiber, labor, chemicals, and hydro have more than doubled in the same period. Like virtually every other North American pulp exporter, we have been caught in a cost/price squeeze that is largely beyond our ability to control." British Columbia pulp was thus uncompetitive with Scandinavian pulp in Europe following the devaluations, he added.

PAPER-GRADE MARKET PULP PRODUCTION AND OPERATING RATES (000 metric tons)

	Production 1983	Production change 1982-83 (%)	Operating rates 1982	Operating rates 1983
U.S.	4385	4.0%	85.3%	87.4%
Canada	5880	7.5	80.2%	84.5%
Sweden	2790	10.1	70.5%	77.9%
Finland	1705	5.0	75.6%	85.3%
Norway	110	10.0	45.5%	50.0%
Total	14,870	6.7	78.7%	83.7%

Source: Jack Puusepp, Pemberton Securities, Ltd.

Even with discounting in NBKP, some paper mills were switching from northern to southern fiber to save still more money on pulp, further eroding the pricing structure. Ashby notes that a portion of the chaos in pricing also resulted from the effect of integrated U.S. mills that, as paper demand weakened, began to push unneeded pulp onto the market—with the result, Smith Barney's Adler estimates, that the operating rate of traditional U.S. market pulp mills in 1982 averaged below 80%.

By some point in 1982, many North American pulp mills that were still taking orders could be considered to be losing money on exports. Topp estimates that coastal British Columbia mills were losing about $80/metric ton on their overseas shipments in late 1982 and he expected the average for 1983 to be about the same. Interior B.C. mills, he believes, will lose more than $10/ton this year on export business but will continue to be marginally profitable on the minor amounts they ship to the U.S.

The most efficient eastern Canadian mills may make about the same amount on U.S. shipments as their interior B.C. competitors, according to Topp, but will lose $20/ton on overseas shipments. Those losses will diminish as the year goes on, Topp believes, but Puusepp noted that a great deal depends on whether the U.S. dollar weakens in 1983.

European demand for North American pulp will be "extremely weak" in the first half of the year, Puusepp cautioned, with Europe's needs increasingly being satisfied by Scandinavian producers, barring the weakening of the dollar. Puusepp also sees Latin American demand as depressed throughout the year, "as many nations in the area will be forced into currency devaluations and lagging their recovery."

While overseas demand will remain weak through at least the first half of the year, most observers think U.S. demand won't be a lot better. Assuming a 2.5% to 3.5% growth in the U.S. real GNP, most paper industry executives think uncoated free-sheet shipments will grow at a matching rate, while coated paper shipments will rise by slightly more than the top end of that range, and tissue shipments by about 3%.

Furthermore, producer inventories in the U.S. and overseas are still close to the peak of the current cycle. Mangels thinks Norscan inventories, at 1.8 million tons at the start of the year, will drop to around 1.4 million tons at year's end, while Smith Barney's Adler believes they could fall as far as 1.2 million. Topp fears they may have to drop farther than that, however, to recover the $545 price by early 1984.

On the other hand, Ashby noted that consumer inventories are very low and "as producer inventories drop to normal levels, we will see a price turnaround."

One positive result from the current weakness has been the postponement or cancellation of a number of planned capacity expansions. Adler noted that U.S. capacity will rise by only 1.9% in 1983, and despite the doubling of

Northwood's capacity in December 1982, Canadian capacity will only increase 2% this year. Kimberly-Clark "has decided not to add to its pulp capacity at this juncture," he pointed out, while an increase in market pulp capacity at International Paper Co.'s Georgetown, S.C., mill "will have relatively little impact in 1983, with the major addition occuring in 1984." Also, Great Northern Nekoosa's Leaf River mill will not be coming on-line until 1984.

As a result, according to Puusepp, "the one product in the forest products sector which offers the best prospects in the next five years is that of market pulp. It is the only area where shortages may appear."

NEWSPRINT

Bottom of market reached

Canada's newsprint mills are sunk in a near depression and will remain in that condition for most of 1983, but most observers believe the situation has reached bottom and won't get much worse. Assuming a rebound in the U.S. economy, consumption should increase roughly in pace with real GNP setting the stage for a modest upturn in operating rates as the year goes on.

Estimates for U.S. consumption in 1982 ranged from 9.9 million metric tons in the case of Pemberton Securities analyst Jack Puusepp to 10.16 million tons in the case of Bowater Sales Co. marketing vice-president Wayne Mangels. Domtar Pulp & Paper Products Group president Roger Ashby thinks 1983 consumption could be as low as 10.2 million tons, while CIP Inc. senior vice president W.P. Woodworth places it at 10.5 million tons.

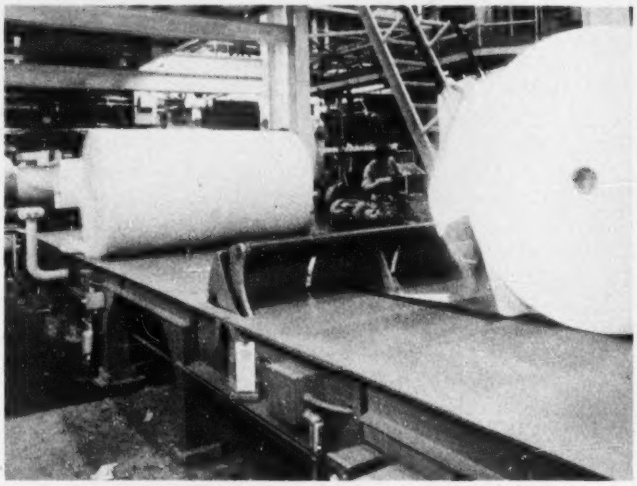
With consumption rising only 2% to 4% and capacity still rising—by 2.3% in the U.S. in 1983 and by 4.5% in Canada—operating rates should remain low. Mangels thinks operating rates will drop from 82% in 1982 to 80% in 1983 in eastern Canada, while Puusepp believes the British Columbia rate will drop from 65% in 1982 to 63.2% in 1983.

Ashby expects a U.S. operating rate of 90% in 1982, rising to about 92% in 1983. That relative strength of U.S. mills points up the key problem of the Canadian industry in 1983: while Canadian mills and U.S. producers have both added capacity at a rapid clip in recent years, U.S. firms gain share in a loose market. Canada should supply only 55% to 56% of U.S. newsprint in 1983, down from 66% just five years earlier. On the other hand, U.S. mills can't afford to become complacent: Ashby warned of a possible return of Scandinavian tonnage to North America due to recent currency devaluations and overcapacity.

Also, part of the increase in consumption will come not from a boost in purchases but rather from a draw-down in inventories, Topp noted. CIP's Woodworth projected a drop in inventory levels from 42 days of supply at the beginning of 1983 to "40 days or less" at the end of the year.

With demand growing at a slow pace and inventory reductions continuing throughout much of the year, price increases will be difficult to get during the year, and indeed Ashby noted that "we feel we'll be lucky to hold level through 1983." Topp forecasts a slight drop in average prices in 1983, to US$480 from $485 in the U.S. and to C$520 from $525 in Canada. Any increase in prices is unlikely before the fourth quarter of 1983, he adds.

On the other hand, Mangels sees prices actually rising by 5% on average—although they will still trail cost increases of 7%, he feels. Topp thinks moderate 1983 settlements in the usually volatile B.C. labor negotiations will keep cost increases to about 6%—compared with 16% in 1982. Puusepp commented that "in Western Canada, the paperworkers will be fortunate to get any wage increase in the new contract year beginning June 1983."



CANADIAN OVERSEAS NEWSPRINT SHIPMENTS
(000 metric tons)

	1982e		1983e	
Destination	**Volume**	**% change year ago**	**Volume**	**% change year ago**
Western Europe	775	6.2%	840	8.4%
Latin America	470	−24.8	515	9.6
Asia	177	−50.3	210	18.6
Oceania	84	−13.4	95	13.0
Africa	53	n.a.	55	3.8
Total	1560	−13.8	1715	9.9

n.m. = not meaningful.
Source: Jack Puusepp, Pemberton Securities Ltd.

Ashby, agreeing with Topp's estimates for 1982 and 1983 cost increases, noted the current pricing outlook "puts a severe squeeze on us from the margin standpoint." He added that "opinion is still out on whether the federal government's 6% and 5% guidelines will be supported sufficiently well to bring these increases under control."

While costs increases should outstrip prices, the Canadian industry will continue to get help from that country's weak currency, with most observers expecting the Canadian dollar to remain between US80¢ and US82¢. A weak currency gives Canadian mills a profit cushion in selling into the U.S. and in overseas markets where they compete head-to-head with Scandinavian producers benefiting from substantial currency devaluations in 1982.

Woodworth believes Europe and Southeast Asia look "promising," with about a 10% increase in shipments possible, while Puusepp forecasts an 8.4% increase in Canadian shipments to Western Europe and a jump of 18.6% to Asia because that continent "has been the most depressed" as a newsprint market. Mangels, pointing to Europe and Latin America as the most promising, fears shipment levels still won't go up at all, however—and he thinks the Canadian dollar could climb as high as US85¢, which most observers agree would hurt Canadian exports.

Koplik Overseas Ltd. newsprint vice-president Juan Carlos Fogth tagged Central and South America and Southeast Asia—especially Singapore, Indonesia, and Malaysia—as the most promising markets. He thinks "the Far Eastern markets such as Taiwan and Hong Kong will be dominated by Japanese suppliers who have the advantage of favorable freight rates and a record low rate of exchange.

"The European market will be difficult at best because of Scandinavia's devaluations," although "a weak Canadian dollar would help to offset the Scandinavian devaluation advantage." He still said it will take an "uphill battle to maintain existing markets" against overseas competitors, however, with new domestic capacity in India and Argentina also diminishing two previously strong markets for Canadian newsprint.

Long-term problems face the Canadian industry aside from the need to find healthy overseas markets. Topp predicted the construction of more "political" mills in the next few years—mills, he said, such as the proposed Matane Peninsula mill in Quebec, backed by the Quebec government partially to spur employment in the region.

While that is complicating the current overcapacity picture, Topp added that a number of Canadian companies face a looming increase in tax liabilities and may want to reduce that exposure by modernizing further, by increasing capacity or by upgrading capacity to produce groundwood specialties—especially with the possibility that companies may want to launch spending programs in the next two years for fear they will lose federal modernization subsidies should the Conservatives win the next election.

UNCOATED GROUNDWOOD

Modest demand rebound ahead

Uncoated groundwood mills should benefit in 1983 from an expected recovery in demand for business papers plus continued strength in commercial printing, observers agree, but excess capacity among newsprint and lightweight coated paper mills that compete with uncoated groundwood producers could keep operating rates artificially low, depressing prices for most of the year.

Sometimes seen as a "second choice" grade for customers unable to buy enough newsprint or LWC—as well as being an upgrade option for old newsprint machines—uncoated groundwood seems to face an increasingly confused future. By mid-decade, excess LWC and newsprint capacity should be mostly absorbed by the market, which should tighten up the groundwood supply/demand equation and produce healthy profit margins. But at the same time, a number of old Canadian newsprint machines will become unable to compete economically with newer units, raising the possibility that enough of them could be upgraded to uncoated groundwood to partially destabilize that market just when conditions would otherwise be looking up.

CIP Inc. senior vice-president W.P. Woodworth expects "continuing upgrading to some degree" in coming years, but few observers see widespread, major conversions in 1983-84 other than Abitibi-Price's conversion of Beaupré, Que., to produce 145,000 metric tpy of such grades as groundwood forms paper starting in 1983. Capital spending budgets have been held to a bare minimum, and most analysts agree with Woodworth that it will be a year or two before groundwood mills return to fairly full operating rates.

Mills producing top-quality uncoated groundwood publication papers, such as the supercalendered sheets made by Madison Paper Industries, St. Regis Paper, and CIP Inc., will have difficulty keeping their machines running full-out for as much as another two years, Jones Heward & Co. analyst Brian Topp believes, since demand will be weak and LWC capacity will be in excess for at least that long.

And even Wayne Mangels, vice president-marketing of Bowater Sales Co., who expects SC markets to tighten up by 1984, warns: "I think Finland intends to supply increasing amounts of SC clay-filled sheets" to the North American market.

Uncoated groundwood prices will remain soft as long as the whole publication paper market is soft, Mangels warned. But he and other observers expect to see a strong performance by forms, inserts, and commercial printing, pushing consumption up 3% to 4% in Woodworth's view and as much as 4% to 5% in Mangels' opinion, after a drop of 2% in 1982.

Topp believes North American operating rates will average slightly below 90% in 1983, up two or three points from 1982, although Woodworth thinks that the rate for Canada will not exceed the "low-80s to mid-80s." Mangels notes that surplus LWC should siphon off some insert business from high-brightness uncoated groundwood.

Mangels also believes lightweight uncoated groundwood paper consumption will rise 3% in 1983. Most observers think lightweight grades could become more competitive in the next few years, with Consolidated-Bathurst having started up a new 69,000-metric-tpy directory and forms paper machine at Trois Rivières, Que., in 1982—and with the coming breakup of American Telephone & Telegraph adding an element of confusion about how many companies will be buying directory paper in the future. ■

WASTEPAPER

Record low prices; nowhere to go but up

■ Wastepaper glutted the market for most of 1982 and mills paid historically low prices. In the last quarter of the year, however, supplies began disappearing as collectors became discouraged by low prices and generating mills and converting plants took substantial downtime.

In November, it appeared as though No. 1 news, old corrugated containers, and pulp substitutes markets were strengthening, leading many market observers to feel these grades would lead the others out of the slump.

But this apparently was due not to any substantial

Canadian labor focuses on West

■ Focus of Canadian contract talks moves to the West Coast from the East this year. In British Columbia, 16 companies with 20 pulp and paper mills will be going to the bargaining table, while in eastern Canada only two companies with three mills have labor contracts expiring.

Negotiations should differ drastically from talks held when the former contract expired June 30, 1981, because companies can no longer afford the hefty wage settlements of previous years. In fact, the wage increase in 1983 is likely to be zero, according to Don Saunders, president of the Pulp & Paper Industrial Relations Bureau, which is bargaining agent for 15 of the B.C. companies involved in labor talks this year. "The industry just doesn't have the capacity to increase any of its costs," said Saunders.

B.C. producers took substantial downtime in 1982 in both the pulp and paper and the wood products industries, and unemployment at pulp and paper mills was about 25% late in 1982, while about one-third of all forestry workers were laid off, he noted. Sawmills are expected to run better in 1983 due to an increase in housing starts that began as interests rates declined late in 1982, but the pulp and paper industry will have a flat year, said Saunders.

NONMONETARY IMPROVEMENTS. Rather than higher wages, unions will probably have to settle for nonmonetary improvements in contracts in such areas as management rights, work contracted out, job security, extended recall rights and supplemental unemployment insurance payments, he explained.

CANADIAN PAPER INDUSTRY 1983 BARGAINING CALENDAR

Company	Mill location	Union*	Contract expires
British Columbia			
BCFP	Crofton	CPU,PPWC	6/30
	Mackenzie	CPU	6/30
BC Timber	Castlegar	PPWC	6/30
	Prince Rupert	PPWC	6/30
Canadian Forest	Port Mellon	CPU	6/30
Cariboo	Quesnel	CPU	6/30
Crestbrook	Skookumchuck	PPWC	6/30
CZ Canada	Campbell River	CPU	6/30
Eurocan	Kitimat	CPU	6/30
Finlay	Mackenzie	CPU	6/30
Intercontinental	Prince George	CPU, PPWC	6/30
MacMillan Bloedel	Nanaimo	PPWC	6/30
	Port Alberni	Other	6/30
	Powell River	CPU	6/30
Northwood	Prince George	CPU, PPWC	6/30
Prince George	Prince George	CPU, PPWC	6/30
Western Forest	Port Alice	CPU	6/30
	Woodfibre (Squamish)	PPWC	6/30
Tahsis	Gold River	PPWC	6/30
Weyerhaeuser	Kamloops	PPWC	6/30
Scott Paper	New Westminster	CPU	6/30
Eastern Canada			
Rolland	Mt. Rolland, Que.	CPU	4/30
	St. Jerome, Que.	CPU	4/30
Prince Albert	Prince Albert, Sask.	CPU	7/31

*CPU=Canadian Paperworkers Union; PPWC=Pulp, Paper & Woodworkers of Canada.

Art Gruntman, Canadian Paperworkers Union West Coast vice-president, said the union is waiting until the spring to decide its goals in 1983, but noted that it would hinge on the condition of the industry when talks start. A priority of the union, however, will be getting a shorter work week. Gruntman said this would keep production in line with demand and reduce unemployment. The union will also seek improvements in pension plans, which have remained unchanged for four years.

The attitude the industry is likely to take in 1983 negotiations was demonstrated late in 1982 when companies refused to extend an 18-month limitation on worker recall rights. Recall rights guarantee that former workers who are laid off will be recalled before new applicants are hired. The companies indicated that to extend those rights would cost more because rehired workers have more seniority rights than new people. When the unions agreed to waive all seniority rights of recalled workers, the industry still refused to grant the request.

ONE-YEAR SETTLEMENT. If the union feels it cannot negotiate a contract to its liking, it will settle for what it feels it can get, but the term of the new agreement will be one year instead of two, said Gruntman, who feels strikes are not likely to happen unless industry operating rates improve substantially when talks start.

There will probably be as many as 10,000 workers less represented in 1983 negotiations than there were two years ago due to extensive layoffs, said Gruntman. He expects closer to 50,000 workers, members of CPU as well as the Pulp & Paper Workers of Canada and International Woodworkers of America, will be involved in the 1983 talks compared to 60,000 members in 1981, when the industry was operating nearly at capacity.

Following a six-week strike in the summer of 1981 B.C. unions got a two-year contract calling for wage increases of 15% the first year and 13% the second year. Last year, the CPU negotiated contracts in eastern Canada calling for wage increases of 12% the first year and 10% the second year, bringing the base wage in 1982 to C$11.38 in the East compared to C$12.96 in B.C.

If a one-year contract calling for lower wage increases is negotiated on the West Coast this year, it might not only achieve the Eastern region's goal of wage parity with the West, but also cause most of the industry's labor agreements to come up for renewal in 1984.

MODERATING TREND IN U.S. In the U.S., the trend toward lower wage increases and union concessions, which began in 1982 as industry conditions deteriorated, is likely to continue in 1982, observers say.

Some of the concessions won by the industry in 1982 include giving management more flexibility in running the mill, establishing labor-management committees to study ways to reduce health costs, and wage increase deferrals, according to American Paper Institute's employee relations vice-president Richard P. Klinzing.

Wage settlements in the pulp and paper industry during the first ten months of 1982 showed a moderating trend, averaging 7.1% across the country compared to yearly averages of 8.7% in 1981 and 9.2% in 1980. Wayne E. Glenn, president of the United Paperworkers International Union, feels that the settlements in 1983 will range from 6% to 7%. Labor expert and P&P columnist Julian Kien agrees, noting that unemployment is likely to remain at about 10% and pulp and paper profits will continue to be weak.

PRODUCTIVITY UP. Kien also feels that employers will continue to negotiate productivity improvements through contract changes and work schedules. For the first nine months of 1982, productivity in the pulp and paper industry was 0.9% higher than in the same period in 1981, a higher increase than the 1980-81 change, but lower than in previous years, according to Klinzing.

John Nee, group director of employee relations at St. Regis Paper Co., feels that both companies and unions will want to ratify three-year agreements in 1983 because

MAJOR CONTRACTS BY REGION ON 1983 U.S. PAPER INDUSTRY BARGAINING CALENDAR

Company	Mill location	Union	No. of employees	Contract expires
	New England Region			
Diamond	Hyde Park, Mass.	U	217	1/1
James River	Jay, Maine	U,O	189	6/1
Boise Cascade	Rumford, Maine	U	1276	6/30
Federal	Sprague, Conn.	U	182	7/10
	Eastern Region			
Simpson	Miquon, Pa.	U	270	2/14
Scott	Fort Edwards, N.Y.	U,B,O	488	3/31
Penntech	Johnsonburg, Pa.	U,O	593	4/10
St. Regis	Deferiet, N.Y.	U,A,O	597	5/1
James River	4 New Jersey (Riegel) mills	U	739	5/31
Intl. Paper	Ticonderoga, N.Y.	U	700	6/1
Finch, Pruyn	Glens Falls, N.Y.	U,A,B,O	625	6/15
Container Corp.	Philadelphia, Pa.	U	305	6/19
Hammermill	Lock Haven, Pa.	U	689	6/20
Diamond	Plattsburgh, N.Y.	U	280	8/1
Georgia-Pacific	Lyons Falls, N.Y.	U	218	8/10
St. Regis	York, Pa.	U	201	9/22
Appleton Papers	Roaring Springs, Pa.	U	399	11/17
Westvaco	Luke, Md.	U,B,O	1421	12/1
	Midwest Region			
Pentair	Niagara, Wis.	U,O	548	1/31
Procter & Gamble	Green Bay, Wis.	U	1532	4/30
James River	Ashland, Wis.	U	162	5/1*
Port Huron	Detroit, Mich.	U	182	5/1
Port Huron	Port Huron, Mich.	U	249	5/1
Scott	Marinette, Wis.	U	607	5/14
Green Bay Pkg.	Green Bay, Wis.	U	124	5/31
GN Nekoosa	Nekoosa, Wis.	U,A,O	753	5/31
GN Nekoosa	Port Edwards, Wis.	U,A,O	917	5/31
Nicolet Paper	De Pere, Wis.	U	329	5/31
Mead	Escanaba, Mich.	U,A	876	6/1
Packaging Corp.	Rittman, Ohio	U	371	6/1
St. Regis	Sartell, Minn.	U	330	6/1
Container Corp.	5 Midwest mills	U	400	6/19
Blandin Paper	Grand Rapids, Minn.	U	965	6/30
Flambeau	Park Falls, Wis.	U	515	7/31
Champion	Hamilton, Ohio	U	1517	9/14
Procter & Gamble	Cheboygan, Mich.	U	483	9/26
Weston Paper	Terre Haute, Ind.	U	156	10/21
Diamond	Lockland, Ohio	U	280	11/1
Sorg Paper	Middletown, Ohio	U	595	11/1
Plainwell	Plainwell, Mich.	U	236	12/1
	Southern Region			
Gulf States	Demopolis, Ala.	U	381	1/6
Hammermill	Selma, Ala.	U,B	185	3/6 7/6
Buckeye	Foley, Fla.	U	790	3/14
Champion	Pasadena, Texas	U	1196	5/29
Container Corp.	Fernandina Beach, Fla.	U,A,B	636	5/31
Georgia-Pacific	Palatka, Fla.	U,A,B	1319	5/31
Intl. Paper	Multiple mill group	U,A,B	7632	5/31
Scott	Mobile, Ala.	U,B	2750	5/31
Union Camp	Savannah, Ga.	U,A,B,O	1625	5/31
Gilman Paper	St. Marys, Ga.	U,A,B	771	6/5
Georgia-Pacific	Crossett, Ark.	U,A	1674	6/12 6/30
Champion	Courtland, Ala.	U	997	6/15
Continental	Port Wentworth, Ga.	U,A,B,O	443	6/19
Continental	Hodge, La.	U	660	6/30
ITT Rayonier	Fernandina Beach, Fla.	U,B	497	6/30
ITT Rayonier	Jesup, Ga.	U,A,B,O	1151	6/30
Manville Forest	West Monroe, La.	U	996	6/30
St. Regis	Lufkin, Texas	U,A,B	860	6/30
Alton Packaging	Jacksonville, Fla.	U,B	316	6/30
Westvaco	Wickliffe, Ky.	U	353	6/30
Bowater Southern	Calhoun, Tenn.	U,B	1160	7/2
Boise Southern	DeRidder, La.	U	477	7/14
Abitibi-Price	Augusta, Ga.	U	188	7/27
Brunswick Pulp	Brunswick, Ga.	U	730	7/31
Augusta Newsprint	Augusta, Ga.	U	188	7/27
Crown Zellerbach	Bogalusa, La.	U,B	762	7/31
Kimberly-Clark	Memphis, Tenn.	U	1059	7/31
Potlatch	McGehee, Ark.	U	235	7/31
Temple-Eastex	Evadale, Texas	U,B	877	7/31
Weyerhaeuser	Plymouth, N.C.	U,B,O	1576	7/31
Continental	Augusta, Ga.	U,B	768	8/14
Weyerhaeuser	Pine Bluff, Ark.	U	181	8/17
Georgia Kraft	Macon, Ga.	U,A,B	470	8/27
Georgia Kraft	Rome, Ga.	U,A,B,O	660	8/27
Champion	Roanoke Rapids, N.C.	U	451	8/31
Willamette	Hawesville, Ky.	U	296	8/31
Federal	Riegelwood, N.C.	U	1180	9/8
Kimberly-Clark	Coosa Pines, Ala.	U,A,B,O	1330	9/14
Owens-Illinois	Valdosta, Ga.	U,B	360	9/15
Great Southern	Cedar Springs, Ga.	U,B	645	9/30
St. Regis	Monticello, Miss.	U	415	9/30
Olin	Pisgah Forest, N.C.	U	1908	10/5
Bowater Carolina	Catawba, S.C.	U	713	10/29
James River	Naheola, Ala.	U,B	1349	10.31
Georgia Kraft	Mahrt, Ala.	U	289	10/31
Inland	New Johnsonville, Tenn.	U	150	10/31
Interstate	Riceboro, Ga.	U	248	10/31
Owens-Illinois	Big Island, Va.	U	251	10/31
Stone	Florence, S.C.	U	443	10/31
Union Camp	Montgomery, Ala.	U	443	10/31
GN Nekoosa	Ashdown, Ark.	U	999	11/1
Weyerhaeuser	Valliant, Okla.	U	236	11/14
Willamette	Campti, La.	U	198	11/15
Federal	Richmond, Va.	U	124	11/29
Westvaco	Covington, Va.	U	1208	11/30
Weyerhaeuser	New Bern, N.C.	U	357	12/19
St. Regis	Houston, Texas	U	426	12/31
	Pacific Coast Region			
Kimberly-Clark	Fullerton, Calif.	W	625	3/15
Willamette	Albany, Ore.	W	312	6/1

U=United Paperworkers Intl. Union; A=Intl. Assn. of Machinists & Aerospace Workers; B=Intl. Brotherhood of Electrical Workers; W=Assn. of Western Pulp & Paperworkers; O=Other.

Source: American Paper Institute Employee Relations Dept.

of concern about the uncertain economy. He also feels that as the economy returns to normal, so will relations between employers and employees, and unions will no longer be willing to concede to companies' demands.

In the interim, however, 1983 could prove a volatile year for bargaining because a number of companies are contemplating closing marginal operations if the economy does not improve by mid-1983, said Nee. "Job losses and plant closures will only further induce conflict at the bargaining table," he pointed out. ■

ENVIRONMENT

Clean Air Act rewrite due in 1983

■ The U.S. pulp and paper industry in 1983 will be affected by developments in environmental regulation on three fronts:

1. Congressional review of the Clean Air Act under the act's ongoing reauthorization procedure, whereby industry could benefit from efforts in the House and Senate to both streamline the act and simplify industry's technology and permitting requirements;
2. Upcoming amendments to the Clean Water Act during reauthorization, including probable postponements in industry's 1984 compliance deadlines under the current act, and final rules by Environmental Protection Agency governing "best conventional technology" (BCT) requirements for control of conventional pollutants discharged from pulp and paper mills; and
3. Congressional amendment of the Resource Conservation & Recovery Act (RCRA) during reauthorization, which could broaden the scope of hazardous waste regulation, and upcoming regulation by EPA governing land disposal of hazardous waste and financial responsibilities for storage and disposal facilities.

AIR ACT AMENDMENTS. While the paper industry as well as the Reagan Administration hoped to pass legislation in 1982 to amend the Clean Air Act, the process has extended into 1983 due to the difficulty of reaching a House-Senate compromise and to last year's congressional postponement of action on the act due to the November elections. At year-end, the Administration abandoned hope for any rewrite in 1982 and planned to press for a limited extension of the act in the lame-duck session.

Major revisions of the act the paper industry would like to see include modification of the "prevention of significant deterioration" (PSD) program, which classifies areas that have attained national clean air standards into Class I, II, or III areas, depending on their degree of "clean air," and permits increments of pollution accordingly; abandonment of stringent lowest achievable emission rate (LAER) standards in nonattainment, or "dirty air" areas where national ambient air quality standards (NAAQS) have not been met; and making uniform technology control requirements which equate best available control technology (BACT) to new source performance standards (NSPS) where they exist.

The House version of a Clean Air bill, HR 5252, sponsored by Rep. Thomas A. Luken (D-Ohio), addressed the above three issues and essentially streamlined permitting procedures for new facilities. However, a controversial amendment has been added to the PSD provision which would restore the act's mandatory Class II areas—whereas the original language in HR 5252 would have dispensed with all Class II designations—and initial paper industry support for the bill has faltered.

The Senate bill, meanwhile, under direction of Sen. Robert T. Stafford (R-Vt.), chairman of the Environment & Public Works Committee, proposed several changes to the law last year which addressed acid precipitation control programs, interstate transport of pollutants, hazardous air pollutants, extension of deadlines to December 1985 for attainment of national standards for sulfur dioxide, particulate, and nitrogen dioxide, and streamlining state permitting procedures under the state implementation plan (SIP) process.

Stafford's committee also offered a package of amendments which could potentially expand Class I areas and mandate long-term air quality goals for large facilities emitting over 1000 tpy of any air pollutant. Nonattainment amendments would replace the LAER technology requirement with BACT and would waive the emission-offset requirement for facilities that would not comprise more than 1% of total emissions in a nonattainment area.

Thus, the clean air legislation that is emerging, judging by the areas of agreement between the Senate and House, will likely contain the following specific provisions:

- In attainment areas, no changes will be made to the PSD increment system in Class I areas, in fact, more areas may be studied to warrant such classification. States will likely have more say in determining Class I areas.
- In Class II areas, where most paper mills are located, the increment system of pollution allowance will not be eliminated, as paper industry lobbyists would prefer, but may have the daily increment allowance replaced with a yearly allowance.
- Attainment deadlines for states to achieve national air-quality levels, currently targeted for December 1982, will likely be extended to the mid- to late-1980s.
- Case-by-case determination of BACT will likely be required for new facilities emitting 500 tpy or more of air pollutants in both attainment and nonattainment areas of the country. It is also likely that BACT will be equated to NSPS for sources under the 500-tpy threshold.
- In nonattainment areas, LAER standards may be replaced by industry-supported BACT standards, thus simplifying control-technology requirements and giving states more flexibility to consider cost, energy and other factors in establishing control requirements.
- The visibility protection program will apply only when there is "significant" impairment rather than "any" impairment as in the current law.

ENERGY

Purchased fuel price hikes to slow

■ The 1983 outlook for pulp and paper industry energy prices is a good one. Successful conservation measures and reduced demand due to the worldwide recession have slowed price increases for fuel oil and natural gas—two high-cost sources of paper industry purchased energy.

Most analysts do not expect OPEC to be able to raise the price of crude oil above its 1982 $34/barrel benchmark level in the near future—indeed, downward pressure on prices for at least two years is expected by some. And the American Gas Assn. in November predicted that consumer prices for natural gas would rise only 5%/year between 1982 and 1987, while wellhead price increases would average 8%/year during the period compared with 16%/year between 1977 and 1982.

In addition, the paper industry continued to increase its dependence on self-generated and residue sources of energy in 1982, as it has over the past ten years. Self-generated and residue energy sources now account for nearly 53% of the industry's total energy consumption, up from 41% a decade ago (see table).

The bright energy picture does not extend to every region of the country, however. In the Pacific Northwest, electrical power customers were given a 58% rate hike last fall from the Bonneville Power Administration—a federal agency that generates hydroelectric power at Columbia River dams for the region. That rate increase was on the heels of a 67% rate hike in 1981, and the BPA plans to ask for another hike this year.

While direct customers, including Crown Zellerbach's Port Townsend, Wash., mill, will bear the brunt of the rate increase, indirect customers such as Weyerhaeuser Co., Georgia-Pacific Corp., and Boise Cascade Corp. will be affected as well, although to a much lesser degree.

MANDATORY COAL-SWITCH PRESSURES EASED. The regulatory burden facing the paper and other industry in the field of energy use has been eased somewhat by the Reagan Administration, and that trend should continue into 1983. Most recently, the Dept. of Energy in November revised its rules implementing the Fuel Use Act, making it clear that the DOE will not force existing boilers to be converted to coal use, as is currently possible under the Act. It is as close as the Administration has come to actual repeal of the FUA, which it intends to consider this year. Earlier, the DOE made it easier for owners of new industrial boilers to get exemptions from FUA's requirement of oil or gas use.

The outlook for cogenerators in the pulp and paper industry is brighter as well. Last June the Supreme Court upheld the constitutionality of the Public Utility Regulatory Policies Act (PURPA) by rejecting the state of Mississippi's argument that the law intrudes on state utility regulation. The High Court's decision on PURPA, a law that encourages cogeneration by exempting cogenerators from utilities regulation and directs utilities to pay fairly for cogenerated power, should serve to ease current uncertainties over cogeneration investment.

A second federal appeals court ruling, however, struck down Federal Energy Regulatory Commission rules requiring utilities to pay cogenerators full avoided costs for their power. American Paper Institute and the FERC have both requested Supreme Court review of the lower court's ruling.

Meanwhile, cogeneration bills which are supported by the paper industry are currently under consideration in both the Senate and the House. House bill HR 6500 would set the federal rate for utility purchase of cogenerated power at full avoided cost. It would also allow states to set avoided cost below the 100% ceiling if justified, and would require mandatory interconnection between utilities and cogenerators.

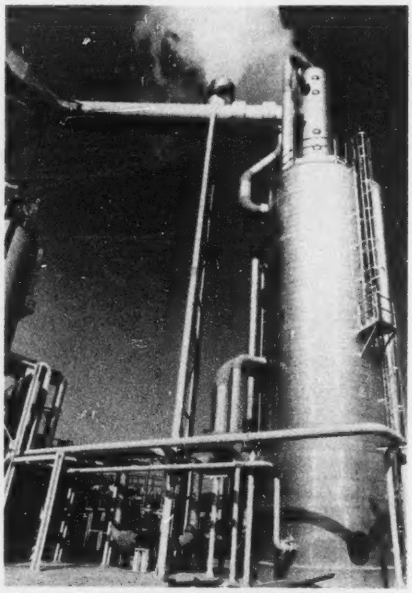
Senate bill S 1885 would reestablish a full avoided cost rate at the federal level for the sale of cogenerated power to a utility and make mandatory interconnections between cogenerators and utilities for the sale of cogenerated power.

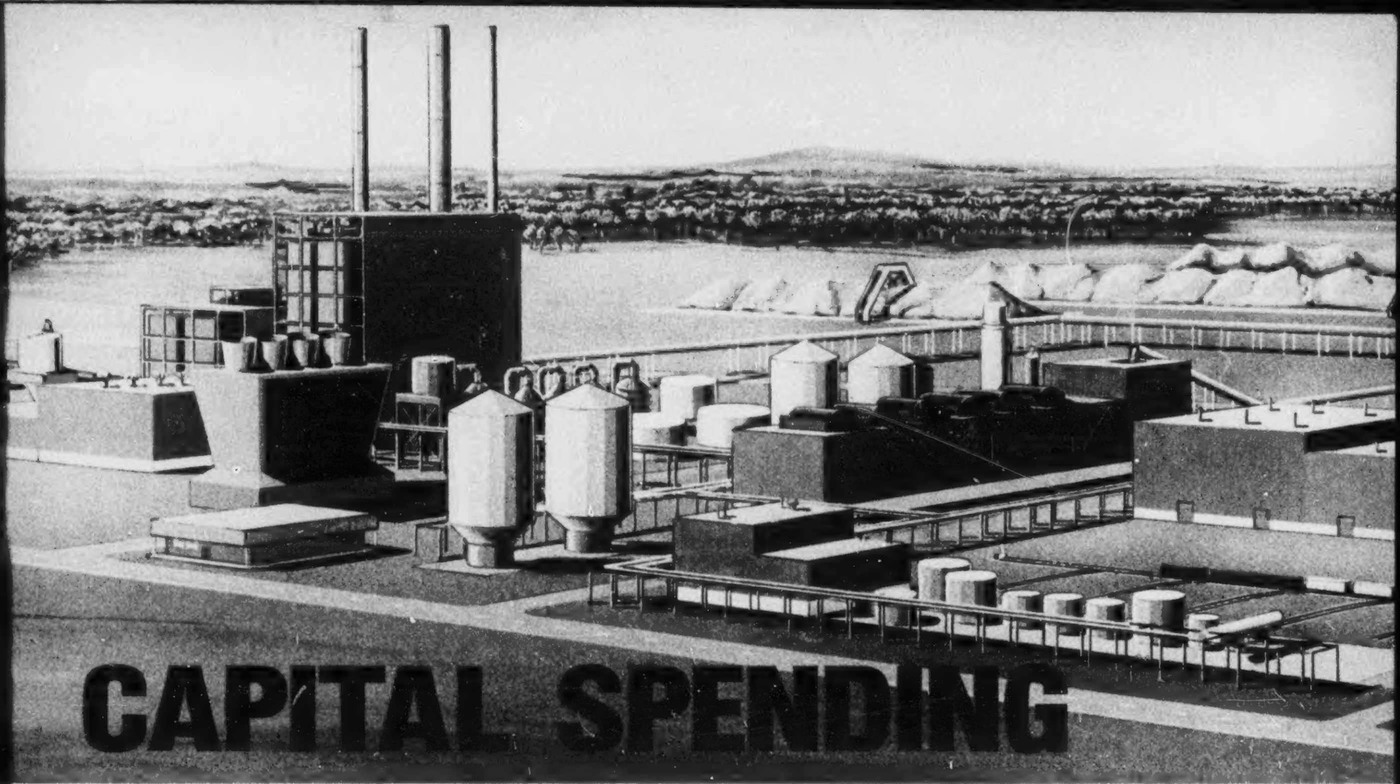
According to API, the paper industry supports the bill, except for the provision which would allow utilities to own 100% rather than 50% of cogeneration facilities eligible for PURPA benefits. ■

U.S. PULP, PAPER, PAPERBOARD INDUSTRY ESTIMATED FUEL AND ENERGY USE

Source	Third-quarter 1982	1981	1972
Purchased electricity	6.6%	6.8%	4.4%
Coal	12.1	10.8	9.8
Residual fuel oil	11.5	10.6	21.3
Distillate fuel oil	0.3	0.3	1.0
Natural gas	16.9	19.5	21.5
Other purchased energy	0.2	1.0	1.1
Total purchased fossil fuel and energy	**48.4**	**48.0**	**59.1**
Woodwaste	7.7	6.7	2.0
Bark	5.4	5.3	4.6
Spent pulping liquors	37.6	39.1	33.7
Self-generated hydroelectricity	0.5	0.5	0.4
Other self-generated	0.4	0.4	0.2
Total self-generated and waste fuels	**51.6**	**52.0**	**40.9**
Total energy	**100.0**	**100.0**	**100.0**

Source: American Paper Institute





Artist's rendering (above) is of new GNN/Leaf River Forest Products Inc. 350,000-tpy market pulp mill at New Augusta, Miss., one of two greenfield mills under construction in the U.S. targeted for 1984 start. (The other project is Union Camp's 210,000-tpy white paper mill at Eastover, S.C.)

CAPITAL SPENDING

Survey reflects lowered targets but reports $13.5 billion in planned spending in U.S./Canada, with 44 new paper/board machines, 67 major mill expansions

REPORTED SPENDING 1982-84+, BY TYPE OF FACILITY[1]

UNITED STATES		
Wood/fiber	$ 454,780,000	6%
Pulping	1,648,314,000	20%
New machines	667,000,000	8%
Machine modifications	519,200,000	6%
Energy/power	2,289,095,000	28%
Miscellaneous/plant	1,795,056,000	22%
PRODUCTION TOTAL	$7,383,445,000	90%
Water quality	$ 365,258,000	4%
Air quality	459,949,000	6%
Solid waste/unspecified	15,203,000	0%
ENVIRONMENTAL TOTAL	$ 840,410,000	10%
TOTAL SPENDING[2]	$8,223,855,000	100%
CANADA		
Wood/fiber	C$ 185,135,000	3%
Pulping	1,833,286,000	35%
New machines	611,300,000	12%
Machine modifications	299,364,000	6%
Energy/power	608,776,000	12%
Miscellaneous/plant	1,122,203,000	21%
PRODUCTION TOTAL	C$4,660,064,000	89%
Water quality	C$ 316,187,000	6%
Air quality	275,230,000	5%
Solid waste/unspecified	2,312,000	0%
ENVIRONMENTAL TOTAL	C$ 593,729,000	11%
TOTAL SPENDING[3]	C$5,253,793,000	100%

1. Includes projects, as announced, for completion in 1985 and later (based on data reported to PULP & PAPER)
2. Total dollar figures includes estimated $1,292,000,000 for projects to be completed in 1985 and later.
3. Dollar total includes estimated C$697,000,000 for projects to be completed in 1985 and later.

By STEPHANIE POLLITZER, Consulting Editor

☐ The current (end-1982) economic climate has put a damper on capital spending planning for expansion and modernization projects at U.S. and Canadian pulp and paper mills. Data compiled by PULP & PAPER for this annual review of the North American industry's spending programs list a grand total of just under $13.5 billion; this covers programs for the 1982-84 period and also includes $2 billion (about 15%) for projects to be completed in 1985 and later. The total reported a year ago was 15% higher, at $15.9 billion (which included $3.6 billion—22%—for projects to be completed after the 1981-83 period under review).

Stretchouts and indefinite postponements for planned projects have been announced by both U.S. and Canadian mills, but few projects have been cancelled outright.

Capital spending by U.S. mills during the year 1982 was expected to be about $5.96 billion, according to the last U.S. Commerce Dept. survey (taken in late October-November 1982). This is about 11.3% below the $6.72 billion spent in 1981. McGraw-Hill Economics' annual fall spending survey (November 1982) estimates 1982 spending at $6.2 billion. For 1983, the McGraw-Hill survey forecasts a 7% increase in U.S. pulp/paper industry spending to $6.63 billion.

Data from a mid-1982 Statistics Canada survey report an expected outlay by the Canadian industry of

C1.79 billion in 1982, down 16.5% from $2.14 billion in 1981.

Environmental spending. Programs for environmental control listed in the 1983 P&P survey represent 10% of total spending reported by U.S. mills (with 90% assigned to production-related programs). U.S. environmental spending reached a plateau in 1977 (to meet the 1977 standards), when it was 25% of U.S. total. In three of the intervening years, environmental spending has been 10% or 11% of total, with a "blip" up to 13% in the 1982 survey (for 1983 air-quality standards).

In Canada, environmental spending has run a steadier course—averaging 13% or 14% in the last seven surveys (1977 on) except for 16% in 1978 and 12% in 1980. The 1983 survey shows 13% of Canadian spending to be for environmental control (87% for production projects).

About the survey data. The tables and lists in this report are compiled from P&P's annual survey of expansion/modernization programs at U.S. and Canadian mills. Assignment of cost data to the various categories (for example: pulping, new machine, or energy/power) is based on information from the companies, if available, but in many cases reflects an estimate by P&P staff and should be considered as approximations.

The dollar figures represent the total cost of the reported projects and sometimes may include supporting equipment. The total cost is assigned to the startup year —not to year(s) of expenditure.

Every effort is made to have the P&P annual spending survey as complete and accurate as possible. Some companies make no public announcements of capital-investment programs, and other firms do not release financial information for announced programs. Thus it is recognized that P&P's survey data are incomplete.

Information is compiled from the many companies that do report their programs in detail, and also from other information that has been publicly released. The data do not normally include spending for woodlands nor for off-site converting facilities.

Basic rules that are followed by P&P staff in assigning cost data to the various categories include the following: recovery boilers are listed under "pulping" unless specifically identified as an "environmental" project; the large multi-million-dollar projects for a "new machine" or "greenfield mill" are divided into the appropriate categories, presuming a reasonable assumption of proportionate costs; "miscellaneous" includes identifiable stock preparation, coating and finishing operations as well as plant and building structure, and unidentifiable projects reported as "miscellaneous."

SEVEN-YEAR CAPITAL SPENDING TRENDS

UNITED STATES

P&P's reported 3-year spending ($, billion)

Year	Period	Production	Environment Water	Environment Air	Total	Annual capital expenditures[1]
1983	1982-84	$6.095[2]	$0.376[3]	$0.460	$6.931[2]	$(6.00)[4]
1982	1981-83	6.216[2]	0.635[3]	0.677	7.528[2]	6.30
1981	1980-82	7.783[2]	0.531	0.568	8.882[2]	6.54
1980	1979-81	8.003[2]	0.515	0.360	8.001[2]	6.80
1979	1978-80	4.911	0.350	0.251	5.759[5]	5.55
1978	1977-79	4.431	0.611	0.307	5,489[5]	4.41
1977	1976-78	3.455	0.783	0.433	5.001[5]	3.36

1. Based on data from U.S. Commerce Dept; data for 1978, 1979 and 1980 have been revised.
2. 1983 data does not include $1.292 billion for projects to be completed 1985 and later; 1982 data does not include $2.8 billion estimated for projects to be completed in 1984-86; 1981 data does not include $1.150 billion estimated to be spent in 1983-85; 1980 data does not include $0.877 billion estimated to be spent in 1982-85.
3. 1983 data includes $0.015 billion for 'solid waste/unspecified'; 1982 data includes $0.050 billion for 'solid waste.'
4. P&P estimate
5. Includes unallocated funds of $0.246 billion for 1979; $0.140 billion for 1978; $0.320 billion for 1977; $0.900 billion for 1976 surveys.

CANADA

P&P's reported 3-year spending (C$, billion)

Year	Period	Production	Environment Water	Environment Air	Total	Annual capital expenditures[1]
1983	1982-84	C$3.990	C$0.295	C$0.272	C$4.557[2]	C$(2.60)[4]
1982	1981-83	3.949[2]	0.438[3]	0.365	4.752[2]	2.83
1981	1980-82	3.645[2]	0.303	0.329	4.277[2]	3.06
1980	1979-81	2.440[2]	0.187	0.135	2.078[2]	2.11
1979	1978-80	1.462	0.110	0.113	1.685	1.55
1978	1977-79	1.442	0.166	0.112	1.720	1.26
1977	1976-78	2.169	0.189	0.157	2.548	1.29

1. Data from Statistics Canada; includes capital and repair expenditures for equipment and facilities.
2. 1983 data does not include C$0.697 billion for projects to be completed in 1985 and later; 1982 data does not include C$0.314 billion estimated for projects to be completed in 1984-86; 1981 data does not include $0.643 billion estimated to be spent in 1983-85; 1980 data does not include $0.684 billion estimated to be spent in 1982-85.
3. 1983 data includes C$0.002 billion, and 1982 data includes C$0.031 billion designated for 'solid waste' control.
4. P&P estimate.

UNITED STATES

South continues its leadership; energy projects get much attention

The recession-impacted returns for P&P's 1983 survey of spending plans at U.S. mills total $8.2 billion dollars. This is 20% below last year's $10.3 billion and the lowest total reported for the U.S. industry since 1979. The $8.2 billion figure includes $1.3 billion for projects to be completed in 1985 and later; it does not include programs which have been indefinitely postponed nor proposed programs for which no startup date has been set.

The South continues its lead over other U.S. regions in expansion plans and accounts for 63% of the spending reported in the 1983 survey (up from 60% last year, and 55% in 1980). Total spending reported for the South (three Census southern regions) is $5.2 billion. More than $1 billion is reported by two southern states: South Carolina ($1.3 billion) and Alabama ($1.1 billion). Mississippi is the third-ranking state ($920 million). Other leading southern states are Georgia ($657 million) and

TOP SPENDERS IN U.S.

Companies for which P&P reports capital spending plans of $100,000,000 or more, including production and environmental programs

	1982-84	1981-83
Champion International	$796,780,000*	$ 800,974,000*
Union Camp Corp.	744,800,000	803,900,000*
Weyerhaeuser	603,460,000	1,243,100,000*
International Paper	600,000,000	878,000,000
Great Northern Nekoosa	582,120,000†	176,349,000*
St. Regis Paper	556,862,000	820,638,000
Scott Paper	431,000,000*	395,500,000
Crown Zellerbach	420,000,000*	530,900,000*
Mead Corp.	331,200,000	440,200,000
MacMillan Bloedel Inc.	308,120,000	318,355,000
Independent Kraft	244,000,000	—
Augusta Newsprint/Abitibi	242,205,000	243,495,000
Federal Paper Board	237,496,000	175,130,000
Hammermill Paper	178,648,000*	274,346,000
Bowater North America	149,670,000	63,500,000
Pentair Inc.	115,271,000*	103,800,000
Continental Forest Ind.	115,000,000	262,000,000
Westvaco	100,000,000	140,000,000

*Includes programs for completion beyond 3-year period indicated.
†Includes Leaf River project, reported separately last year.

Total cost of a multi-year project is assigned to the year of startup.

SUMMARY OF U.S. PROJECTS— REPORTED EXPENDITURES, 1982-84+[1] BY STATES (000 dollars)

STATE	PRODUCTION	ENVIRONMENTAL	TOTAL
Alabama	$1,046,540	$ 74,790	**$ 1,121,330**
Arizona	47,000	—	**47,000**
Arkansas	10,021	1,800	**11,821**
California	127,600	—	**127,600**
Connecticut	31,623	—	**31,623**
Florida	183,600	7,617	**191,217**
Georgia	617,175	39,900	**657,075**
Idaho	1,692	1,600	**3,292**
Illinois	6,000	—	**6,000**
Indiana	3,155	—	**3,155**
Louisiana	58,000	10,000	**68,000**
Maine	429,846	42,680	**472,526**
Massachusetts	5,575	—	**5,575**
Michigan	756,155	126,135	**882,290**
Minnesota	316,738	44,123	**360,861**
Mississippi	785,000	135,000	**920,000**
New Hampshire	87,000	5,000	**92,000**
New York	6,986	350	**7,336**
North Carolina	364,440	29,380	**393,820**
Ohio	72,374	1,270	**73,644**
Oklahoma	115,000	7,000	**122,000**
Oregon	49,198	21,912	**71,110**
Pennsylvania	58,023	40,630	**98,653**
South Carolina	1,215,670	132,000	**1,347,670**
Tennessee	75,646	13,500	**89,146**
Texas	136,486	7,550	**144,036**
Virginia	71,700	9,258	**80,958**
Washington	436,700	65,300	**502,000**
West Virginia	518	3,470	**3,988**
Wisconsin	267,984	20,145	**288,129**
Total	**$7,383,445**	**$840,410**	**$ 8,223,855[2]**

1. Includes projects, as announced, for completion in 1985 and later.
2. Dollar figure includes estimated $1,292,000,000 for projects to be completed in 1985 and later. ($1,288,000,000 production; $4,000,000 environmental).

MAJOR MODERNIZATION/ EXPANSION PROJECTS IN U.S.

(over $45,000,000 at an existing mill site)

Alton Packaging, Jacksonville, Fla.	$ 54,000,000
Augusta Newsprint/Abitibi, Augusta, Ga.	242,205,000*
Bowater Carolina, Catawba, S.C.	70,700,000
Bowater Southern, Calhoun, Tenn.	78,000,000
Champion International, Courtland, Ala.	172,070,000*†
Champion International, Canton, N.C.	80,940,000 †
Chesapeake, West Point, Va.	59,900,000 †
Container Corp., Fernandina Beach, Fla	75,000,000
Continental Forest Industries, Hodge, La.	66,000,000
Crown Zellerbach, Camas, Wash.	400,000,000*†
Federal Paper Board, Riegelwood, N.C.	215,000,000
Hammermill, Selma, Ala.	127,000,000
ITT Rayonier, Jesup, Ga.	120,000,000
International Paper, Bastrop, La.	64,000,000
International Paper, Georgetown, S.C.	500,000,000
James River, Berlin, N.H.	50,000
Kimberly-Clark, Coosa Pines, Ala.	74,500,000
Longview Fibre, Longview, Wash.	78,000,000
MacMillan Bloedel, Pine Hill, Ala.	294,170,000*
Mead, Escanaba, Mich.	300,000,000*
Pentair/Niagara, Niagara, Wis.	46,391,000 †
Pentair/Flambeau, Park Falls, Wis.	51,365,000 †
Philip Morris/Wisconsin, Menasha, Wis.	72,613,000*
Potlatch/Northwest, Cloquet, Minn.	46,000,000
St. Joe Paper, Port St. Joe, Fla.	54,600,000 †
St. Regis Paper, Bucksport, Maine	89,246,000
St. Regis Paper, Sartell, Minn.	309,000,000*
St. Regis Paper, Lufkin, Texas	97,678,000 †
Scott Paper, Mobile, Ala.	80,000,000
Scott Paper, Skowhegan, Maine	195,000,000*
Scott Paper, Westbrook, Maine	65,000,000
Scott Paper, Winslow, Maine	63,500,000
Southwest Forest Industries, Snowflake, Ariz.	47,000,000
Union Camp, Savannah, Ga.	163,000,000
Westvaco, Charleston, S.C.	100,000,000
Weyerhaeuser, Plymouth, N.C.	80,000,000*
Weyerhaeuser Valliant, Okla.	107,000,000*

*Includes new machine (also in listing of New Machines).
†Includes projects for completion in 1985 and later.

Data in this table necessarily omit expansion programs for which cost information has not been released.

North Carolina ($394 million).

The Midwest (two Census regions) accounts for $1.6 billion (20%) of the spending reported in the 1983 survey. Michigan is the Midwest's leader ($882 million), followed by Minnesota ($361 million) and Wisconsin ($288 million).

Spending programs in the West (Mountain/Pacific region) total $751 million, 9% of U.S. total. The West's share has been dropping in recent years, reflecting the long-run shift of new capacity additions to the South. Washington ($502 million) continues to be the leading state in the West.

New England (two Census regions) reports spending plans at $707 million, 8% of U.S. total. Maine ($473 million) remains the leader in this region.

The big spenders. Six companies report spending plans of over $500 million in the 1983 survey (three of these include projects to be completed in 1985 or later). Leader in reported spending is Champion International, with $797 million ($500 million is for the Quinnesec, Mich., mill which is now targeted for 1986 completion; and $172 million for the new paper machine project at Courtland, Ala.).

Union Camp is in No. 2 position, with $745 million ($550 million for the greenfield mill at Eastover, S.C.; and $163 million for major power and woodyard programs at Savannah, Ga.). Weyerhaeuser drops to No. 3 spot, due to postponement of originally-planned additional capacity at the new Columbus, Miss., mill. The $603 million reported for Weyerhaeuser includes $380 million for completion of the first phase at Columbus; and $107 million for a new machine at Valliant, Okla.

International Paper reports spending plans of $600 million, of which $500 million is for conversion of the Georgetown, S.C., mill to white paper and market pulp. Great Northern Nekoosa will spend $582 million, almost all of this ($540 million) for the greenfield Leaf River pulp mill under construction at New Augusta, Miss., to be operated as a division of GNN. St. Regis also reports an over-$500-million program ($557 million), including the new machine project at Sartell, Minn. ($309 million) and two major boiler installations ($180 million) at Bucksport, Maine, and Lufkin, Texas.

New mills and machines. Two new mills started up in the U.S. in 1982. At Columbus, Miss., Weyerhaeuser brought on-line a 175,000-tpy coated groundwood mill. (Ultimately the facility is to include a kraft pulp mill, an uncoated free-sheet machine and a second coated groundwood unit.) The second new mill to start up in 1982 was the 2500-tpy security papers mill of Portals Inc. at Hawkinsville, Ga.

Three mills are under construction. Union Camp is heading for 1984 startup for its 210,000-tpy bleached pulp/white paper mill at Eastover, S.C. Also targeted for 1984 startup is the GNN/Leaf River 350,000-tpy kraft pulp mill at New Augusta, Miss. Champion International's 265,000-tpy hardwood kraft pulp mill at Quinnesec, Mich., is moving toward a 1986 start. Independent Kraft

UNITED STATES—REPORTED CAPITAL EXPENDITURES FOR 1982-84+[1]
BY REGIONS AND BY TYPE OF FACILITY ($000 dollars)

PRODUCTION:	**WOOD/FIBER**		**PULPING**		**NEW MACHINES**		**MACHINE MOD.**		**ENERGY**		**MISC./PLANT**	
New England	$ 10,000	2%	$ 86,145	5%	$ 65,000	10%	$ 83,449	16%	$ 215,300	9%	$ 84,150	5%
Mid-Atlantic	—	—	23,850	1%	—	--	7,150	1%	27,700	1%	6,309	1%
East North Central	56,488	12%	257,179	16%	108,000	16%	136,968	26%	221,976	10%	325,057	18%
West North Central	20,000	4%	62,000	4%	50,000	8%	34,000	7%	40,000	2%	110,738	6%
South Atlantic	107,960	24%	486,680	30%	107,000	16%	118,698	23%	1,139,955	50%	492,810	27%
East South Central	239,800	53%	534,800	32%	222,000	32%	21,116	4%	371,500	16%	517,970	29%
West South Central	8,922	2%	52,230	3%	65,000	10%	38,918	8%	111,666	5%	42,771	2%
Mountain/Pacific	11,610	3%	145,430	9%	50,000	8%	78,901	15%	160,998	7%	215,251	12%
Total	**$ 454,780**		**$1,648,314**		**$ 667,000**		**$ 519,200**		**$2,289,095**		**$1,795,056**	

							TOTALS:					
ENVIRONMENT:	**WATER**		**AIR**		**WASTE/UNSPEC**		**PRODUCTION**		**ENVIRONMENT**		**GRAND TOTAL**	
New England	$ 15,000	4%	$ 32,680	7%	$ —	—	$ 544,044	7%	$ 47,680	6%	$ 601,724	7%
Mid-Atlantic	15,380	4%	25,600	6%	—	—	65,009	1%	40,980	5%	105,989	1%
East North Central	68,960	19%	69,290	15%	9,300	61%	1,105,668	15%	147,550	18%	1,253,218	15%
West North Central	21,480	6%	20,860	5%	1,783	12%	316,738	4%	44,123	5%	360,861	5%
South Atlantic	91,333	25%	129,272	28%	1,020	7%	2,453,103	34%	221,625	26%	2,674,728	33%
East South Central	102,490	28%	120,800	26%	—	—	1,907,186	26%	223,290	27%	2,130,476	26%
West South Central	13,000	4%	10,250	2%	3,100	20%	319,507	4%	26,350	2%	345,857	4%
Mountain/Pacific	37,615	10%	51,197	11%	—	—	662,190	9%	88,812	11%	751,002	9%
Total	**$ 365,258**		**$ 459,949**		**$15,203**		**$7,383,445**		**$ 840,410**		**$8,223,855[2]**	

1. Includes projects, as announced, for completion in 1985 and later.
2. Dollar total includes estimated $1,292,000,000 for projects to be completed in 1985 and later ($1,228,000,000 production; $4,000,000 environmental).

Regions are as follows:
New England: Me., Vt., N.H., Conn., R.I., Mass.
Mid-Atlantic: N.Y., N.J., Pa.
East North Central: Wis., Mich., Ill., Ind., Ohio
West North Central: N.D., S.D., Neb., Kans., Minn., Iowa, Mo.
South Atlantic: Del., Md., W. Va., Va., N.C., S.C., Ga., Fla.
East South Central: Ky., Tenn., Miss., Ala.
West South Central: Okla., Tex., Ark., La.
Mountain/Pacific: Wash., Ore., Calif., Alaska, Ida., Nev., Mont., Wyo., Utah, Ariz., Colo., N.M.

Corp. is not yet under construction but is reportedly aiming for 1984 start of a 280,000-tpy linerboard mill at Tuscaloosa, Ala.

Eleven other greenfield mills are under consideration but have not been assigned a target date (see "New Greenfield Mills" list).

Sixteen new machines are listed. Six of these started in 1982 and ten are scheduled for startup at U.S. mills in the next couple of years. Four are for coated or uncoated free-sheet, three are for groundwood papers, two for linerboard, one for corrugating medium, one for newsprint, one for tissue; four small units are for fiberglass roofing mat. An additional nine machines have been proposed but have received no final approval.

Spending by categories. The only category in the 1983 survey in which reported spending programs significantly exceed those reported in the 1982 survey is "Energy/power." Some $2.3 billion is targeted to be spent in this area of the mill, 28% of U.S. total pulp/paper industry spending. The increase in this category obviously reflects the increased attention being given to energy matters by the industry; it is also to some degree

NEW 'GREENFIELD' MILLS IN U.S.

WITH SCHEDULED STARTUP DATE

Augusta Kraft Co., Augusta, Ga. Proposed 262,500-tpy kraft linerboard mill	**1984**
Champion International, Quinnesec, Mich. 265,000-tpy bleached hardwood kraft pulp mill	**1986**
GNN/Leaf River Forest Products, New Augusta, Miss. 350,000-tpy bleached softwood/hardwood kraft pulp mill	**1984**
Independent Kraft Corp., Tuscaloosa, Ala. 280,000-tpy kraft linerboard mill*	**1984**
Kimberly-Clark Corp.,La Grange, Ga. Proposed plant to produce nonwoven fabrics	**1985**
Portals Inc., Hawkinsville, Ga. New 2500-tpy security papers mill	**1982**
Union Camp Corp., Eastover, S.C. 210,000-tpy bleached pulp/white paper mill*	**1984**
Weyerhaeuser Co., Columbus, Miss. 175,000-tpy coated groundwood paper mill*	**1982**

PROPOSED

Boise Cascade Corp., South Carolina Possible 800-tpd bleached kraft pulp mill under study; with possible addition of one or two paper machines later	**No date**
Carolina Forest Industries, Bennetsville, S.C. Proposed newsprint mill, by Stora Kopparberg/Canal Indus.	**No date**
Champion International, Halifax, N.C. Proposed bleached pulp/paper complex; site purchased	**No date**
Champion International, Jasper, Texas Proposed 1000-tpd unbleached pulp/linerboard mill	**No date**
Georgia Kraft Co., Elberton, Ga. Proposed 1300-tpy linerboard mill; site is purchased	**No date**
Grenada Paper Co., Grenada, Miss. Proposed 215,000-tpy news mill (formerly No. Mississippi)	**No date**
Inland Container Corp., Ontario, Calif. Possible recycled linerboard mill	**No date**
Kimberly-Clark Corp., Southeast U.S. Possible pulp mill to supply fiber for disposable diapers	**No date**
Sunbelt Forest Products Corp., Boligee, La. Proposed 210,000-tpy newsprint mill	**No date**
Tenma Paper Mills & Co., Brunswick, Ga. Proposed 70-80,000-tpy clay-coated SBS foodboard mill	**No date**
Wilbert Associates, Globe, Ariz. Possible 175,000-tpy newsprint mill	**No date**

*Machine included in "New Machines" listing

NEW PAPER MACHINES IN U.S.

WITH SCHEDULED STARTUP DATE

Augusta Newsprint Co./Abitibi, Augusta, Ga. 226,000-tpy, 336-in.-trim Valmet—newsprint	**1983**
Bird & Son, Charleston, S.C. 18,000-tpy, 120-in.-trim Sandy Hill—fiberglass roofing mat	**1983**
Champion International, Courtland, Ala. 145,000-tpy, 288-in.-wire Beloit—uncoated free-sheet	**1983**
Crown Zellerbach, Camas, Wash. 160,000-tpy, 276-in.-trim Beloit—uncoated free sheet	**1985**
Genstar Stone Products Co., Ennis, Texas 25,000-tpy, 165-in.-wide Sandy-Hill—fiberglass roofing mat	**1983**
Independent Kraft Corp., Tuscaloosa, Ala. 280,000-tpy, 256-in.-trim machine—linerboard	**1984**
MacMillan Bloedel Inc., Pine Hill, Ala. 210,000-tpy, 284-in.-wire Tampella—corrugating medium	**1982**
Mead Corp., Escanaba, Mich. 200,000-tpy, 305-in.-trim, Valmet—coated. groundwood	**1982**
Owens-Corning Fiberglas, Aiken, S.C. New Sandy Hill unit—fiberglass roofing mat	**1982**
Philip Morris/Wisconsin, Menasha, Wis. 65,000-tpy, 208-in.-trim Beloit—tissue	**1982**
St. Regis Paper Co., Sartell, Minn. 170,400-tpy, 314-in.-trim Beloit—coated groundwood	**1982**
Scott Paper Co., Skowhegan, Maine 200,000-tpy, 290-in.-trim Beloit—coated free-sheet	**1983**
Tamko Asphalt Products Inc., Joplin, Mo. New Sandy Hill unit—fiberglass roofing mat	**1983**
Union Camp Corp., Eastover, S.C. 210,000-tpy, 372-in.-wire Voith—uncoated free-sheet	**1984**
Weyerhaeuser Co., Columbus, Miss. 175,000-tpy, 289-in.-trim Beloit—coated groundwood	**1982**
Weyerhaeuser Co., Valliant, Okla. 194,000-tpy, 268-in.-trim, KMW-Johnson—linerboard	**1982**

PROPOSED

Blandin Paper Co., Grand Rapids, Minn. Proposed 175,000-tpy unit—lightweight coated groundwood	**No date**
Boise Cascade Corp., International Falls, Minn. Possible new machine—uncoated groundwood	**No date**
Fort Howard Paper Co., Muskogee, Okla. Planning for fourth machine underway—tissue	**No date**
Georgia-Pacific, Crossett, Ark., or Palatka, Fla. Possible 300,000-tpy, 349-in. trim unit—kraft paper/board	**No date**
Georgia-Pacific, Port Hudson, La. Possible 138,000-tpy unit—uncoated free-sheet	**No date**
Longview Fibre Co., Longview, Wash. Proposed No. 12 paper machine—lightweight kraft	**No date**
Southeast Paper Mfg. Co., Dublin, Ga. Possible second 158,000-tpy machine—recycled newsprint	**No date**
Westvaco Corp., Wickliffe, Ky., or Luke, Md. 150,000-tpy machine—coated free-sheet	**No date**
Weyerhaeuser Co., Columbus, Miss. Add two machines—unctd free-sheet; coated groundwood	**No date**

attributable to more accurate reporting by mills and more accurate assignment of costs by P&P.

Programs identified as "Plant/miscellaneous" account for $1.8 billion, 22% of U.S. total. This is considerably lower than the "miscellaneous" total reported a year ago and is greatly due to the more accurate allocation of costs to the "energy" category in this current survey.

Expansions and modifications at pulp mills, including bleach plant and recovery boilers, account for $1.6 billion, 20% of U.S. total. Programs for woodyard improvement, chip handling, etc., were segregated into a separate category, "Fiber/woodyard," for the first time in this 1983 survey. The total for this new category is $455 million, 6% of U.S. Together these two areas of the mill represent 26% of the 1983 U.S. total spending (in 1982, the combined "Pulping/fiber" category was 28% of the U.S. industry's total).

Spending for "New machines" in the 1983 survey totals $667 million, 8% of U.S. This is a substantial reduction from the year-ago figure (which included 11 machines that came on-line in 1981). Some $519 million is allocated to modifications of paper machine, 6% of total.

Environmental spending plans reported in the 1983 survey total $593 million. Water-quality programs account for $316 million (53% of environmental spending) and air-quality programs for $275 million (46%). Solid waste programs were reported at $2 million (less than 1% of environmental total).

Spending by region. The South, of course, continues to lead all other areas in pulp/paper spending programs, with $5.2 billion reported in the 1983 survey, 63% of total U.S. spending. (Current capacity in the South is approximately 59% of U.S. combined pulp and paper total.) Expansion/modernization plans in the Midwest total $1.6 billion, 20% of U.S. (Midwest pulp/paper capacity is roughly 13% of U.S.) Spending programs in the West, at $751 million, are 9% of U.S. total. (Western capacity is about 15% of U.S.) The Northeast planned programs will cost $708 million, 8% of U.S. total. (Northeast capacity is 13% of U.S.)

SUMMARY OF CANADIAN PROJECTS—REPORTED EXPENDITURES 1982-84+[1] BY PROVINCES ($000 Canadian dollars)

PROVINCE	PRODUCTION	ENVIRON-MENTAL	TOTAL
Alberta	$ 183,440	$ 30,000	**$ 213,440**
British Columbia	859,337	136,151	**995,488**
Manitoba	3,495	—	**3,495**
New Brunswick	499,149	44,083	**543,232**
Newfoundland	74,850	—	**74,850**
Nova Scotia	133,335	6,300	**139,635**
Ontario	1,804,326	142,641	**1,946,967**
Quebec	1,070,612	234,554	**1,305,166**
Saskatchewan	31,520	—	**31,520**
Total	**$4,660,064**	**$593,729**	**$5,253,793[2]**

1. Includes projects, as announced, for completion in 1985 and later.
2. Dollar total includes estimated C$697,000,000 for projects to be completed in 1985 and later ($670,000,000 production; $27,000,000 environmental).

CANADA

Government aid in eastern provinces permits increased spending plans

Spending programs by Canadian pulp/paper mills reported in the 1983 survey total C$5.3 billion, a modest 6% below the 1982 figure. Government support for expansions in Ontario and Quebec is behind the higher levels reported by the two big provinces, which counterbalance lowered targets elsewhere in Canada. The $5.3 billion figure includes $697 million for projects to be completed in 1985 and later; it does not include programs which have been indefinitely postponed or for which no startup date has been set.

The province of Ontario reports plans to spend $1.9 billion, 37% of the country's total (a rise from 28% in last year's survey). Most of this is for production-related programs—$1.8 billion, or 93%; environmental programs will get 7%, or $143 million.

Quebec mills are reporting $1.3 billion in spending plans, 25% of Canadian total (up from 21% in 1982). Production projects will get $1.1 billion (82%) and environmental programs will cost $235 million (18%).

The West (provinces of British Columbia and Alberta) has spending plans for $1.2 billion, 23% of the nation's total (a large drop from 34% reported last year). Of the $1.2 billion, $1 billion (86%) is targeted for production projects and $166 million (14%) for environmental programs. The B.C. industry has been hit hard by reduced export markets and continuing higher costs.

Spending plans for the Maritimes (New Brunswick, Newfoundland, Nova Scotia) are reported at $758 million, 14% of the total (down slightly from 16% a year ago). Canada's "Central" region (Manitoba and Saskatchewan) has few pulp/paper mills and modest plans to spend $35 million, 1% of the country's total (unchanged from last year).

Company spending plans. Seven companies report spending programs of more than C$300 million (one more than in the 1982 survey) and 20 companies report spending plans for at least $100 million (same number as last year).

Consolidated-Bathurst plans to spend $372 million, with major programs at Bathurst, N.B., Ville de La Baie, Trois Rivières (new groundwood specialty machine) and Shawinigan, Que. Great Lakes Forest Products will spend $356 million, with $340 million on a renovation at Dryden, Ont. (with new uncoated free-sheet machine).

B.C. Forest Products plans $350 million, for a newsprint machine at Crofton, B.C., and greenfield newsprint mill at Hurdy, Alta. (due for 1985 or later start).

Ontario Paper is spending $346 million at Thorold, Ont., primarily for two new newsprint machines now online at the mill. (About $10 million of Ontario's spending is for projects now postponed to 1985 or later.) Abitibi's budget is for $345 million, designed primarily for a new newsprint machine at Iroquois Falls, Ont., and major programs at Grand Falls, Nfld., and Beaupré, Que.

Rexfor/Soucy is, with substantial government participation, embarking on a $325 million, greenfield 160,000-metric-tpy newsprint mill at Matane, Que. Northwood Pulp & Timber has completed a $320-million expansion at its kraft market pulp mill at Prince George, B.C.

New mills and machines. One new mill (Donohue Normick at Amos, Que.) started up in 1982. Two mills (BCFP at Hurdy, Alta., and Rexfor/Soucy at Matane, Que.) are scheduled for construction but may not meet targeted startup dates.

Five new newsprint machines came on-line at Canadian mills in 1982: BCFP at Crofton, B.C.; Crown Zellerbach at Campbell River, B.C.; the new Donohue Normick unit at Amos, Que.; and two machines for Ontario Paper at Thorold, Ont. Con-Bath started a new groundwood specialty machine at Trois Rivières, Que.

Spending by categories. Pulp is of great importance to the Canadian industry and receives a larger share of attention (and funding) than in the U.S.

TOP SPENDERS IN U.S.

Companies for which P&P reports capital spending plans of $100,000,000 or more, including production and environmental programs

	1982-84	1981-83
Champion International	$796,780,000*	$ 800,974,000*
Union Camp Corp.	744,800,000	803,900,000*
Weyerhaeuser	603,460,000	1,243,100,000*
International Paper	600,000,000	878,000,000
Great Northern Nekoosa	582,120,000†	176,349,000*
St. Regis Paper	556,862,000	820,638,000
Scott Paper	431,000,000*	395,500,000
Crown Zellerbach	420,000,000*	530,900,000*
Mead Corp.	331,200,000	440,200,000
MacMillan Bloedel Inc.	308,120,000	318,355,000
Independent Kraft	244,000,000	—
Augusta Newsprint/Abitibi	242,205,000	243,495,000
Federal Paper Board	237,496,000	175,130,000
Hammermill Paper	178,648,000*	274,346,000
Bowater North America	149,670,000	63,500,000
Pentair Inc.	115,271,000*	103,800,000
Continental Forest Ind.	115,000,000	262,000,000
Westvaco	100,000,000	140,000,000

*Includes programs for completion beyond 3-year period indicated.
†Includes Leaf River project, reported separately last year.

Total cost of a multi-year project is assigned to the year of startup.

NEW 'GREENFIELD' MILLS IN CANADA

(metric tons)

WITH SCHEDULED STARTUP DATE

B.C. Forest Products Ltd., Hurdy, Alta. 175,000-tpy TMP/newsprint mill*	**Delay to 1987**
Donohue Normick Inc., Amos, Que. 159,000-tpy TMP/newsprint mill*	**1982**
Rexfor/Soucy, Matane, Que. 160,000-tpy TMP/newsprint mill	**1984/85**

PROPOSED

Alberta Energy Corp., Whitecourt, Alta. Plans to build 600-tpd pulp mill indefinitely postponed	**No date**
B.C. Cellulose Ltd., Ocean Falls, B.C. Possible cedar kraft pulp mill	**No date**
Doman Industries Ltd., Nanaimo, B.C. Proposed 175,000-tpy TMP mill, possibly newsprint later	**No date**
Makin Project Ltd., Red Deer, Alta. Proposed 85,000-tpy CMP/43,000-tpy printing/writing paper mill, with additional CMP/second paper machine later*	**No date**
Northwood/Alco, Rocky Mtn. House, Alta. Proposed 15-year program for 150,000-tpy kraft pulp mill, TMP mill, 175,000-tpy paper machine; later add CMP mill, second and third paper machines	**No date**
Quebec Public Works Ministry, Maniwaki, Que. Possible 400-tpd medium-density fiberboard mill	**No date**
Saskatchewan Crown Investment Corp., Sask. Very tentative proposal for 175,000-tpy newsprint mill	**No date**

*Machine included in "New Machines" listing

CANADA—REPORTED CAPITAL EXPENDITURES FOR 1982-84+[1] BY REGIONS AND BY TYPE OF FACILITY (000 Canadian dollars)

PRODUCTION:	**WOOD/FIBER**		**PULPING**		**NEW MACHINES**		**MACHINE MOD.**		**ENERGY**		**MISC./PLANT**	
Maritimes	$ 15,170	8%	$ 402,331	22%	$ —	—	$ 29,480	10%	$ 179,538	30%	$ 80,815	7%
Quebec	52,575	28%	374,997	20%	161,300	26%	169,974	57%	124,977	20%	186,789	17%
Ontario	77,390	42%	724,219	40%	250,000	41%	66,510	22%	131,308	22%	554,899	49%
Central	3,950	2%	15,270	1%	—	—	—	—	7,395	1%	8,400	1%
West	36,050	20%	316,469	17%	200,000	33%	33,400	11%	165,558	27%	291,300	26%
Total	**$ 185,135**		**$1,833,286**		**$ 611,300**		**$ 299,364**		**$ 608,776**		**$1,122,203**	

							TOTALS:					
ENVIRONMENT:	**WATER**		**AIR**		**WASTE/UNSPEC.**		**PRODUCTION**		**ENVIRONMENT**		**GRAND TOTAL**	
Maritimes	$ 7,000	2%	$ 43,383	16%	$ —	—	$ 707,334	15%	$ 50,383	8%	$ 757,717	14%
Quebec	116,084	37%	116,358	42%	2,112	91%	1,070,612	23%	234,554	40%	1,305,166	25%
Ontario	95,321	30%	47,320	17%	—	—	1,804,326	39%	142,641	24%	1,946,967	37%
Central	—	—	—	—	—	—	35,015	1%	—	—	35,015	1%
West	97,782	31%	68,169	25%	200	9%	1,042,777	22%	166,151	28%	1,208,928	23%
Total	**$ 316,187**		**$ 275,230**		**$ 2,312**		**$4,660,064**		**$ 593,729**		**$5,253,793**[2]	

1. Includes projects, as announced, for completion in 1985 and later.
2. Dollar total includes estimated C$697,000,000 for projects to be completed in 1985 and later ($670,000,000 production; $27,000,000 environmental).

Note: Tabulations are based on these regional divisions: "Maritimes" is New Brunswick, Newfoundland, and Nova Scotia; "Central" is Manitoba and Saskatchewan; "West" is British Columbia and Alberta; Ontario and Quebec are treated individually.

Planned expenditures for the pulping area reported in the 1983 survey are C1.8 billion, and for the supporting woodyard/fiber area $185 million. Together these two categories account for $2 billion, or 38% of Canada's proposed spending.

Expenditures in the "Plant/miscellaneous" category are reported at $1.1 billion, 21% of the national total. New machines will cost $611 million, or 12% of the total, while modifications of paper machine are budgeted at $299 million, 6% of total. Expenditures for energy and power are planned to be $609 million, 12% of the total.

Environmental programs at Canadian mills account for $594 million of the proposed spending, 11% of total. Water-quality programs will cost $316 million (6% of total), air-quality projects are priced at $275 million (5% of total), with $2 million for "solid waste/unspecified."☐

NEW PAPER MACHINES IN CANADA

(metric tons)

WITH SCHEDULED STARTUP DATE	
Abitibi-Price Inc., Iroquois Falls, Ont. No. 8 190,000-tpy, 352-in.-trim, Valmet—newsprint	**1983**
B.C. Forest Products, Hurdy, Alta. 175,000-tpy machine—newsprint	**1987**
B.C. Forest Products, Crofton, B.C. 175,000-tpy, 300-in.-trim Beloit—newsprint	**1982**
Consolidated-Bathurst, Trois Rivières, Que. 68,000-tpy, 194-in.-trim BC-Kennedy—unctd groundwood	**1982**
Crown Zellerbach Canada, Campbell River, B.C. 175,000-tpy, 360-in.-trim, Valmet—newsprint	**1982**
Donohue-Normick Inc., Amos, Que. 159,000-tpy, 300-in.-trim, Dominion—newsprint	**1982**
Great Lakes Forest Products Ltd., Dryden, Ont. 122,000-tpy, 194-in.trim Valmet—uncoated free-sheet	**1983**
Ontario Paper, Thorold, Ont. Two 310,000-tpy (total), 300-in.-trim Beloit—news/gwd	**1982**
Rexfor/Soucy, Matane, Que. 160,000-tpy, 300-in.-trim machine—newsprint	**1984**
Scott Paper Ltd., New Westminster, B.C. 36,000-tpy, 185-in.-trim KMW—tissue	**1984**
PROPOSED	
Abitibi-Price Inc., Grand Falls, Nfld. No.4 machine (postponed from 1984)—newsprint	**No date**
Abitibi-Price Inc., Iroquois Falls, Ont. New unit (postponed from 1985-86)—newsprint	**No date**
Abitibi-Price Inc., Alma, Que. Proposed new unit—newsprint	**No date**
Consolidated-Bathurst, Bathurst, N.B. Possible replacement of existing unit—corrugating medium	**No date**
Great Lakes Forest Products Ltd., Dryden, Ont. Possible 175,000-tpy machine—newsprint	**No date**
Kruger Inc., Trois Rivières, Que. 172,000-tpy, 300-in. Beloit—newsprint	**No date**
James Maclaren Co., Masson, Que. Proposed 194,000-tpy unit—newsprint	**No date**
MacMillan Bloedel Ltd., New Westminster, B.C. Proposed 75,000-tpy, 159-in.-trim Valmet—unctd free-sheet	**No date**
Makin Project Ltd., Red Deer, Alta. 43,250-tpy, 142-in.Bellmer—several paper grades	**No date**

MAJOR MODERNIZATION/ EXPANSION PROJECTS IN CANADA

(over C$35,000,000 at an existing mill site)

Abitibi-Price, Grand Falls, Nfld.	C$ 49,400,000*
Abitibi-Price, Iroquois Falls, Ont.	132,100,000
Abitibi-Price, Beaupre, Que.	87,200,000
BC Timber, Prince Rupert, B.C.	47,045,000
Boise Cascade Canada, Fort Frances, Ont.	35,000,000 †
Boise Cascade Canada, Kenora, Ont.	150,000,000
Bowater Inc., Liverpool, N.S.	71,000,000
B.C. Forest Products, Crofton, B.C.	150,000,000*
CIP Inc., Dalhousie, N.B.	146,600,000
CanFor/Prince Geo P&P, Prince Geo, B.C.	73,508,000
Consolidated-Bathurst, Bathurst, N.B.	98,000,000
Consolidated-Bathurst, Shawinigan, Que.	43,290,000
Consolidated-Bathurst, Trois Rivières, Que.	75,273,000*
Consolidated-Bathurst, Ville de La Baie, Que.	99,234,000
Crown Canada, Campbell River, B.C.	174,300,000
Domtar, Red Rock, Ont.	62,000,000
Domtar, Donnacona, Que.	45,825,000
Donohue, Clermont, Que.	42,550,000
E.B. Eddy Forest Products, Espanola, Ont.	271,919,000 †
Fraser Inc., Atholville, N.B.	170,000,000
Fraser, Edmundston, N.B.	53,000,000
Great Lakes Forest Products, Dryden, Ont.	345,800,000*
K-C/Spruce Falls, Kapuskasing, Ont.	88,200,000
James Maclaren Co., Thurso, Que.	70,000,000
Northwood Pulp, Prince George, B.C.	320,000,000
Nova Scotia Forest Ind., Point Tupper, N.S.	52,910,000
Ontario Paper, Thorold, Ont.	263,313,000**†
Reed Inc., Quebec City, Que.	120,000,000 †
Scott Maritimes, Abercrombie Point, N.S.	61,125,000 †
Scott Paper Ltd., New Westminster, B.C.	63,000,000*

*Includes new machine (also in listing of New Machines).
†Includes projects for completion in 1985 and later.

Data in this table necessarily omit expansion projects for which cost information has not been released.

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Worldwide naval stores industry

International Naval Stores meeting focuses on gum, tall oil rosin production/demand in the U.S., Europe, South America, and China

By KENNETH E. SMITH, Executive Editor

☐ The U.S. economy will continue to recover, but growth will be sluggish in 1983, according to **Fred L. Buckner**, business group director of resins for Hercules Inc. Addressing about 200 delegates representing 18 countries at the Ninth International Naval Stores meeting in Washington, D.C., Buckner predicted that real gross national product (GNP) will increase by only about 3% this year after an overall decline of 1.4% in 1982. Citing the restrictive monetary policies of the Federal Reserve, high private-sector loan demand, and the outlook for a federal budget deficit of up to $150 billion for fiscal year 1983, Buckner said that interest rates are unlikely to ease enough to allow a stronger recovery (4% to 5% GNP growth) more typical of recent post-recession years. Other speakers at the conference reported on the naval stores industries in the U.S., Europe, Latin America, and Japan, with particular emphasis on rosin, and echoed a somewhat pessimistic outlook for the industry worldwide.

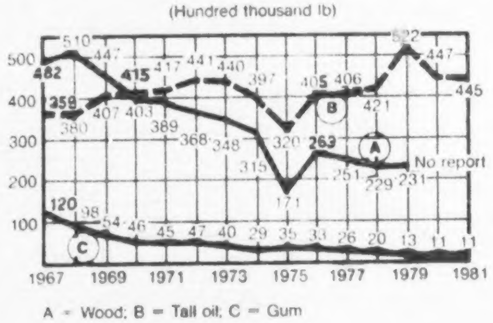
On a more positive note, Buckner noted that major pluses for the economy are a sharp increase in real disposable income and completion of inventory liquidations by most businesses. The recent tax cut and increases in Social Security payments are the main factors behind the increase in real disposable income. Combined with a higher saving rate, revealed in the government's latest revision of national income data, and paydown of installment debt, consumers are in a good position to increase spending.

In other areas important to the naval stores industry, the economic picture is similar. The outlook for Europe's economy is for an increase in real GNP of only about 2% this year. European inventories are believed to be relatively low and will require some rebuilding with any improvement in demand. With their currencies weak relative to the U.S. dollar, Europe's competitive position has improved in world markets, and recovery in the U.S. would be an added source of strength. Government policies, though generally committed to combatting inflation, are likely to become less restrictive in the face of rising unemployment and political pressures.

Latin America experienced no growth in real GNP during 1982 for the second consecutive year, and inflation rates were substantially higher than 1981. Slight economic growth (1%) is expected in 1983, but inflation is not expected to abate. Latin America is plagued by high and increasing debt levels for which the servicing costs are exacerbated by currency devaluation and by the high cost of new borrowings. The debt problems will lead to significantly slower growth in the region over the next several years.

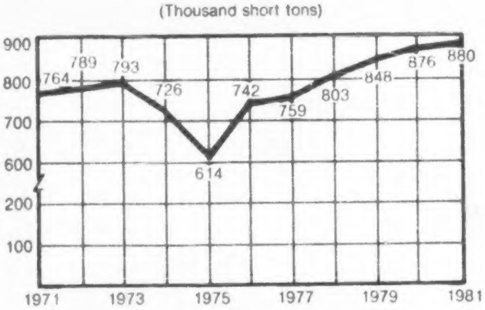
In Japan, the slowdown in exports, stemming from the

FIGURE 1: **U.S. rosin production**



Source: Pulp Chemicals Assn.

FIGURE 2: **Crude tall oil production**



Source: Pulp Chemicals Assn.

slowed by recession in 1982

continuing worldwide recession and the country's voluntary restraint in an attempt to avoid protectionist measures, has resulted in a generally sluggish economy. Real GNP grew only 3.5% in 1982. Assuming an acceleration of economic activity in other world ecomomies, Japan's growth should increase to about 4% for 1983.

U.S. naval stores

MORRIS

Charles W. Morris, vice president and general manager of Sylvachem Corp., spoke on the U.S. production and consumption of tall oil naval stores products. According to Morris, tall oil rosin accounted for more than two-thirds of the rosin produced in 1982. Tall oil rosin is the product of crude tall oil fractionation, which also yields tall oil fatty acids (TOFA).

Crude tall oil production grew during the late 1960s and 1970s at an annual rate of 1.5%, which has been slowed by the current recession. Tall oil fractionation rate has also been slowed and was only 77% in 1982 of the rate in 1981. Morris blames both the recession and technological changes in key markets for this slowdown. The shift from solvent-based enamel paints to water-reducible and high-solids paints has substantially reduced demand for alkyds made from TOFA. Morris predicted that, without intensive new product development, high TOFA inventories would continue throughout the industry in the 1980s.

High inventories are also currently a problem with tall oil rosin. Since 1981, U.S. inventories have increased at a compounded rate of better than 8%. Sluggish activity in the paper industry has reduced demand for rosin size, one of the larger outlets for tall oil rosin. The strong dollar and the worldwide recession have slowed rosin exports. Crude tall oil inventory has also been growing. It reached 89,000 tons in 1982, which is the highest inventory since 1967.

Morris feels the current hard times for the rosin industry are only temporary. He pointed to technical improvements over the past 25 years which have upgraded tall oil rosin and eliminated most of its early, unpleasant characteristics. Also, lately hydrocarbon resins have begun to lose their price advantage over rosin resins due to rapid increases in the price of naphtha, which has risen 600% in the last eight years. Naphtha is a feedstock for ethylene, and petrochemical resins are a byproduct of the ethylene manufacturing process. The price adjustment, combined with improved qualities, may enable tall oil rosin to recapture many markets lost to hydrocarbons resins in the 1960s.

The recent increase in patents issued for tall oil rosin development seems to indicate resurgence of interest in rosin. The number of patents issued between 1972 and 1980 increased by nearly 400% over the number issued between 1961 and 1970. Morris concluded by saying that continued development will open many new markets for tall oil rosin in the next decade; that stability problems would be solved; that color, odor, and taste will continue to improve; and that tall oil rosin has reached a stage where it can be customized for many applications.

European naval stores

SCHULTZ

Dr. Wolf-Stefan Schultz, president of Collodin Chemie, reported on developments in Europe with particular emphasis on naval stores in Fed. Rep. of Germany, which is the largest user of rosin the Europe. According to Dr. Schultz, the major portion of tall oil rosin sold in Europe is from Scandinavia. Finland is the largest Scandinavian producer with an annual capacity of more than 40,000 tons. Sweden has the largest single distillation facility with a capacity of 30,000 tons annually. This plant is operated by Bergvik Kemi, a subsidiary of Stora Kopparberg. Norway has one plant at M. Peterson with a capacity of 12,000 tpy.

Union Camp Corp. owns a fractionation plant in the United Kingdom capable of distilling 24,000 tpy of rosin. This particular plant will distill American crude tall oil for sale to European customers. In addition to these tall oil rosin producers in Europe, Portugal produces about 100,000 tons annually of gum rosin.

Since 1977, tall oil rosin has captured an increasingly large share of the total German rosin imports (about 65,000 tpy average). Most of this rosin is from Scandinavia. About 89% of all German rosin imports are still gum rosin, primarily from China and Portugal.

Schultz also said that research conducted by his company has shown that with special modifications of the rosin, rosin sizing can be used effectively in papermaking at pHs as high as 8, along with large quantities of calcium carbonate as filler. He predicted that rosin size will continue as a universally applicable paper sizing agent, but that demand will be stagnant at a high level by 1990.

In the field of printing-rosins and lac-rosins, the situation is somewhat different. The market for phenol-modified colophonium products is on the decline due to cost pressures prevailing in the industry. The rapidly growing market for illustration printing requires mainly carbonic hydrogen resins, which average $0.09/lb cheaper than comparative rosin derivatives. A growing market does exist in the field of cheap printing inks for calcium and magnesium resinates, which some ink makers produce themselves.

The adhesive market in Germany will remain a growth market because many manufacturing bonding problems can be solved economically through the use of adhesives.

Schultz concluded by saying that American rosin will have only a limited future market in Germany unless American suppliers commit to the market for the long term rather than just selling surplus production there.

G. SMITH

South American naval stores

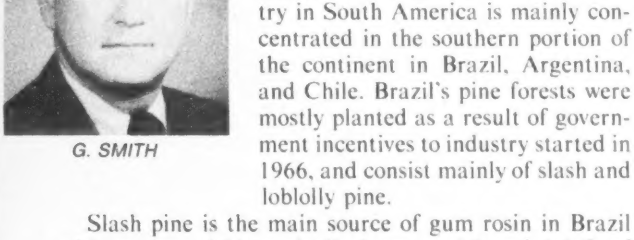
In his report, **Gerard C. Smith**, director and general manager, Hercules Do Brazil Productos Quimicos Ltd., said that the naval stores industry in South America is mainly concentrated in the southern portion of the continent in Brazil, Argentina, and Chile. Brazil's pine forests were mostly planted as a result of government incentives to industry started in 1966, and consist mainly of slash and loblolly pine.

Slash pine is the main source of gum rosin in Brazil with present yields typically between 4.0 and 6.6 lb of gum dip/tree/season, which starts in October and ends in May/June. The typical life cycle of Brazilian pine plantations is 20 to 25 years, and tapping for gum production can begin at 12 years. Assuming 4.4 lb of gum dip/tree and 300 trees/acre, the Brazilian pine forests have the potential to produce about 480,000 tons of dip/year, which is the equivalent of 330,000 tons of rosin and 58,000 tons of turpentine annually.

Actual gum rosin production in Brazil is expected to reach only about 17,000 tpy in the next three to five years, which is about one-half of expected domestic demand (33,000 tpy). This level of gum rosin production will concurrently yield about 2800 tons of turpentine. Of the total amount of rosin consumed in Brazil, about 35% is used in hard resins, 25% in paper size, 20% in disproportionated rosin emulsifiers, and 20% into miscellaneous uses.

Smith reported that Argentina also has a growing naval stores industry based on gum dip from pine plantations. About 5600 tons of rosin are produced annually, which is enough to make the country self-sufficient without significant surplus for export. Chile is gumming its pine plantations on a limited scale with an annual rosin production level of around 1300 tons.

FIGURE 3: **U.S inventory tall oil rosin**



Source: Pulp Chemicals Assn.

Naval stores in the Far East

HAMASAKI

According to **Kokichi Hamasaki**, managing director of Nichimen Corp., Japan imports approximately 67,000 tpy of rosin, about 80% of which comes from China. In 1981, demand for rosin in Japan declined dramatically compared with 1980 because of depressed demand for paper and rubber products. Paper sizing demand declined to 33,000 tons, down about 12% from 1980. Also, petroleum resins have continued to make sizable inroads into rosin markets, and about 90,000 tpy of these resins are used for making paint, printing inks, adhesives, and sizing agents. Hamasaki stated that, in light of present conditions, further growth in demand for naval stores products in Japan cannot be expected.

Hamasaki reported that China now has a rosin production capacity of 670,000 tpy, with about 260 rosin plants, but only produced about 340,000 tons in 1980. China reportedly has large quantities of rosin in inventory, which it will be seeking to export this year. This activity is likely to drive world prices down further.

John Drew, president of Drew Forest Chemicals Laboratory, spoke on the history of the naval stores industry. ☐

TABLE 1: **Tall oil fatty acid inventory**

	(Thousand lb)	
	More than 2% rosin	**Less than 2% rosin**
1972	7,644	6,612
1973	9,919	4,922
1974	8,918	6,252
1975	19,228	7,750
1976	8,321	5,208
1977	9,493	8,280
1978	15,703	10,333
1979	16,315	9,678
1980	56,140	8,108
1981	33,171	14,809
1982		
Jan	28,143	13,938
Feb	22,570	15,128
Mar	20,049	10,160
Apr	22,448	14,896
May	25,771	13,640
Jun	18,721	18,570
Jul	16,100	11,800

Source: Pulp Chemicals Assn.

Chlorine production down, but prices firm

By BARRY SHOCKETT

The production of chlorine has been dropping steadily, and is down 16% for the first eight months of 1982 vs 1981. In August, 698,000 tons of chlorine were produced, a 20% drop. August operating rate decreased to 57.5% (according to the Chlorine Institute), compared with 71% last year and 65% in June 1982. The operating rate for 1982 overall dropped to an estimated 64%, compared with 74% and 80% in 1981 and 1980, respectively. The average selling price increased $20/ton to an estimated $120/ton in the fourth quarter.

Although chlorine demand by the Canadian pulp and paper industry is also down in 1982, production has increased this year primarily because Dow Chemical has been running both its plants full out to supply the customers of Dow Midland, which closed its chloralkali facility in June 1982. Chlorine exports increased to more than 200,000 tpy.

U.S. statistics, chlorine (000 short tons)

	1979	1980	1981	1982e
Capacity (est)	14,200	14,235	14,300	14,500
Production	12,290	11,421	10,558	9300
Imports	133	166	182.5	205
Exports	94	117	50.5	25
Apparent consumption	12,329	11,470	10,690	9480
Pulp and paper	1600	1500	1400	1200

Sources: Bureau of Census, U.S. Dept. of Commerce; PULP & PAPER and industry estimates.

Canadian statistics, chlorine (000 short tons)

	1979	1980	1981	1982e
Capacity	1374	1730	1741	1769
Production	1137	1435	1461	1488
Imports	31	42.5	27	15
Exports	133	166	182.5	205
Apparent consumption	1035	1311.5	1305.5	1298
Pulp and paper	617.5	612.5	571.5	531.5

CHLORINE

UNITED STATES

Uses: Chlorine's major use by the pulp and paper industry is bleaching kraft and sulfite pulps.

Demand: In 1982, the pulp and paper industry used an estimated 1.2 million tons of chlorine (13% of total demand), compared with 1.4 million tons in 1981. The largest end-use is in ethylene dichloride (EDC), and others are organic and inorganic chemicals, and water treatment.

Sources: At least 25 companies in the U.S. produce chlorine and caustic. The major chlorine producers (in descending order of nameplate capacity) include Dow Chemical, PPG Industries, Diamond Shamrock, Hooker Chemicals (Occidental Petroleum), Olin, Georgia-Pacific, Vulcan Materials and Pennwalt. Imports, all from Canada, reached a level of205,000 tons in 1982.

Availability: There is ample industry capacity to handle any increase in chlorine demand. 1982, market; 1981, market; 1980, market; 1979, tight to very tight; 1978, market.

Pricing: For the first time in almost 18 months, the price of chlorine has risen industry-wide. Olin boosted the off-list price by $20/ton in September 1982, and this has held. Pricing history (list price): 1982, $145/ton, f.o.b. works, freight equalized; 1981, $145/ton; 1980, $145/ton; 1979, $135-$150/ton; 1978, $135-$145/ton.

Forecast: Over the long term, pulp mill chlorine use will gradually decrease, just as chlorine dioxide substitution increases. However, 1983 pulp mill consumption will be back to the 1.4 million tons consumed in 1981 if production is up.

CANADA

Uses: Chlorine's major use by the pulp and paper industry is as a bleaching agent in kraft and sulfite pulp mills. Onsite hypochlorite makeup consumes additional quantities.

Demand: An estimated 531,500 tons of chlorine were required by the pulp and paper industry in 1982, a decrease of 40,000 from 1981. The industry used 39% of total demand in 1981, compared with the 43% in 1980 and the 56% in 1979. This change is due to the increase in consumption for EDC production. The production of organic and inorganic chemicals takes most of the rest.

Sources: Major merchant producers include (in descending order of nameplate capacity) Dow Chemical Canada, C-I-L, Canadian Occidental Petroleum, Stanchem Div., PPG Industries, and FMC Chemicals. The three captive producers are Great Lakes Forest Products, Prince Albert Pulp (Saskatoon Chemicals), and St. Anne Chemical. Canso Chemical closed in 1981.

Availability: Although the industry operating rate in 1982 was an estimated 85% (vs 80% in 1981), there were no shortages due to decreased domestic demand. 1982, market; 1981, market; 1980, market; 1979, tight; 1978, tight.

Pricing: There was only one price increase for chlorine in 1982 (Apr. 1) as was the case last year (Oct. 1). Pricing history: 1982, $254-$281.20/ton, bulk, f.o.b. works; 1981, $225-$254/ton; 1980, $195-$255/ton; 1979, $163-$195/ton; 1978, $145-$163/ton.

Forecast: Over the long term, chlorine dioxide replacement will reduce pulp mill chlorine usage, but the rate of decrease will be lower than originally predicted. Only four mills are currently replacing more than 25% of their chlorine. If pulp markets begin to improve next year, chlorine usage by the mills could exceed 545,000 tons by 1983.

Mr. Shockett is consulting editor-chemical markets for PULP & PAPER

PULP & PAPER

February 1983

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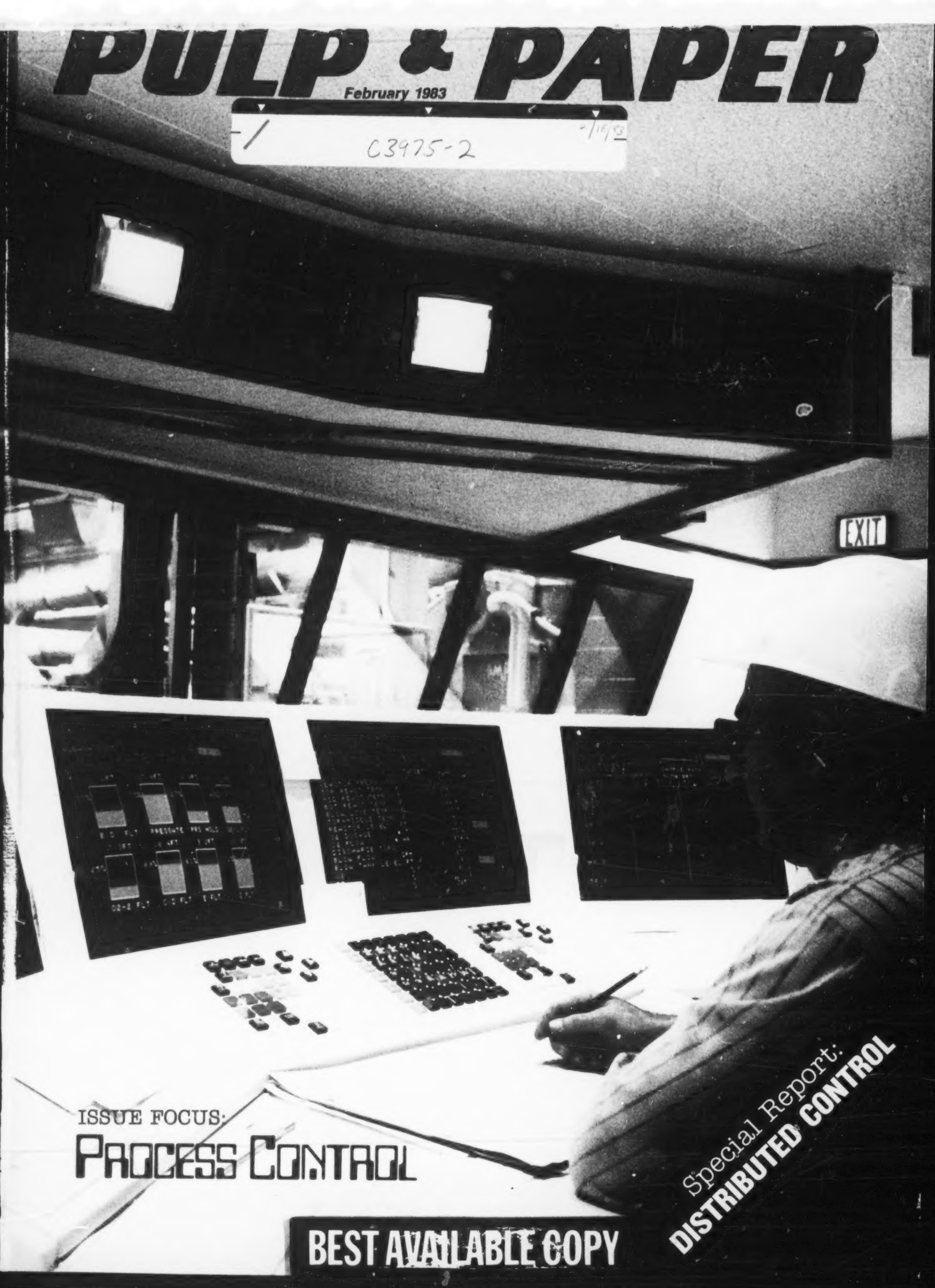

ISSUE FOCUS:
PROCESS CONTROL

Special Report:
DISTRIBUTED CONTROL

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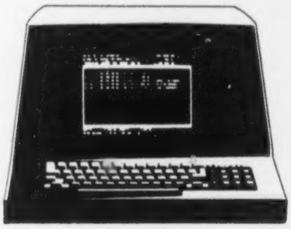
PULP&PAPER

Volume 57 Number 2

February 1983



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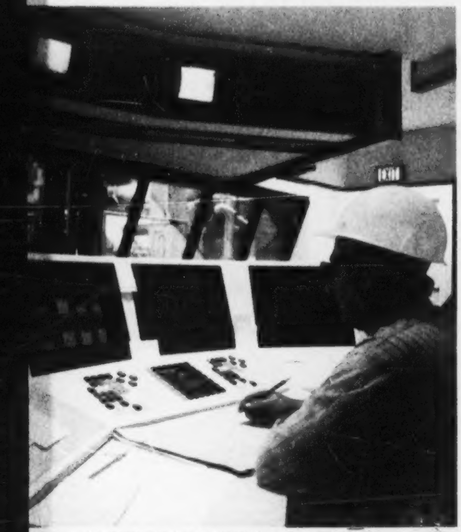

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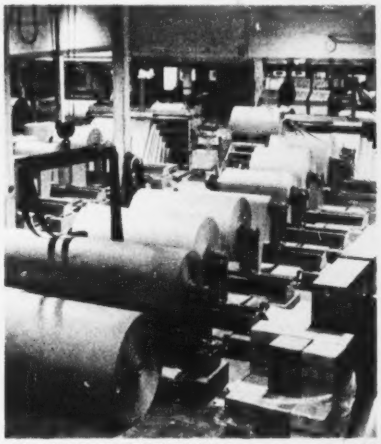

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COVER: *Operation of Union Camp's new oxygen bleaching system at Franklin, Va., is optimized by modern computerized instrumentation. Photo courtesy of Airco Industrial Gases, Murray Hill, N.J.*

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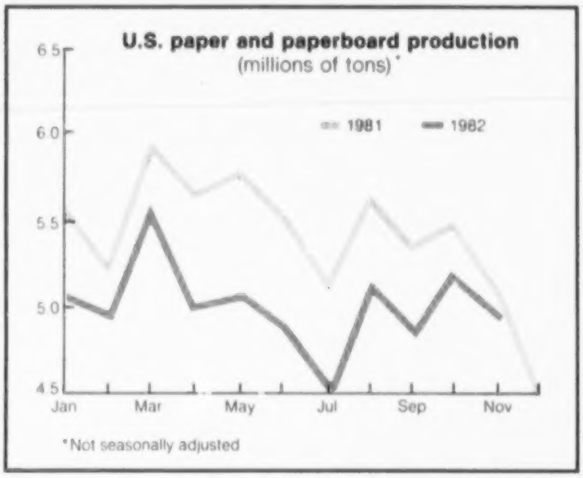
MONTH IN STATISTICS

U.S. paper and paperboard production in November totaled 5.1 million short tons, 0.5% above the November 1981 total, according to the American Paper Institute. The production trend, as measured by the two-month moving average of the seasonally adjusted data, was 60.6 million tpy, slightly below the October trend level. Through November, output was at a seasonally adjusted rate of 59.8 million tpy, 4.6% below year ago.

Among major grades, coated paper output continued to show the strongest trend, and for the year-to-date averaged 5.05 million tpy, up 1.8% over 1981 levels. Newsprint production has now moved below its first-half 1982 rate, but should end the year above the 5-million-ton level. Paperboard output has moved downward during the past two months, and for the first 11 months of the year the seasonally adjusted rate came to 29.4 million tpy, down 6.7% from year ago.Z

Total Canadian newsprint shipments in November came to 692,000 metric tons, down 10.6% from November 1981, according to the Canadian Pulp & Paper Assn. Newsprint mill operating rates rose to 80% from 76% in October, but were well below the 97% rate of a year earlier.


U.S. paper and paperboard production
(millions of tons)*

*Not seasonally adjusted

PAPER & PAPERBOARD PRODUCTION[1]

		Latest month (000 short tons)	% change from year ago	Annualized year-to-date (000 short tons)	% change from year ago
Newsprint	November	411	−9.5	5,104	−3.4
Uncoated groundwood (s)	November	123	4.2	1,452	−1.3
Coated paper (s)	November	431	8.0	5,053	1.8
Uncoated free sheet (s)	November	651	3.3	7,876	−1.4
Unbleached kraft packaging and industrial (s)	November	327	−0.3	3,690	−6.1
Tissue	November	366	−2.4	4,410	−2.9
Total paper	**November**	**2,541**	**−3.9**	**30,514**	**−2.6**
Kraft linerboard, unbleached	November	1,220	3.9	13,844	−6.9
Semichemical medium	November	371	−0.8	4,423	−7.9
Bleached paperboard	November	303	−3.8	3,727	−6.3
Recycled paperboard	November	543	—	6,691	−6.2
Total paperboard	**November**	**2,511**	**1.3**	**29,743**	**−6.7**
Total paper and paperboard*	**November**	**5,053**	**0.5**	**60,257**	**−4.6**

PULP, WASTEPAPER & FIBER[2]

		Latest month (000 short tons)	% change from year ago	Annualized year-to-date (000 short tons)	% change from year ago
Total woodpulp production	October	4,228	−5.2	49,927	−5.7
Market pulp production	October	464	−17.0	5,767	−8.5
Wastepaper consumption at paper / board mills	October	1,210	−10.0	13,802	−3.5
Pulpwood consumption (cords)	November	6,891	−2.4	79,680	−1.8

CONVERTED PRODUCTS STATISTICS[3]

		Latest month (000 short tons)	% change from year ago	Annualized year-to-date (000 short tons)	% change from year ago
Corrugated box shipments (billion ft²)	November	19,043	4.0	217,378†	−4.9
Containerboard inventories at box plants	Nov. 1	2,424	−0.5		

INTERNATIONAL TRADE[2]

		Latest month (000 short tons)	% change from year ago	Annualized year-to-date (000 short tons)	% change from year ago
U.S. paper imports (including products)	October	740	−5.6	8,035	−3.8
Imports of Canadian newsprint	October	n.a.	n.a.	n.a.†	n.a.
U.S. paper exports (including products)	October	373	13.0	4,313	−9.1
Exports of unbleached kraft linerboard	November	145	−4.6	1,892	−1.8
Exports of woodpulp	October	237	−13.8	3,435	−7.5

CANADIAN STATISTICS[4] (reported in metric tons)

		Latest month (000 short tons)	% change from year ago	Annualized year-to-date (000 short tons)	% change from year ago
Total newsprint shipments	November	692	−10.6	7,329†	−9.7
Operating rates	November	80%	97%	83%	94%
Inventories held by U.S. consumers	Nov. 30	1,308	−11.6		
Woodpulp shipments (export only)	November	504	0.6	5,311†	−12.1
Operating rates	November	68%	88%	76%	87%

1. American Paper Institute. 2. API, Bureau of Census, American Pulpwood Assn. 3. Fiber Box Assn., Paperboard Packaging Council. 4. Canadian Pulp & Paper Assn.
*Includes construction and wet machine grades. †Not annualized. ‡Not directly comparable to year ago because of coding change. (s) = shipments.

LABOR

Box plant strikes finally settled

Operations at corrugated box plants throughout Ontario and Quebec, some of which have been on strike since July, were expected to resume in the first week of January. Contracts were signed at about half of the facilities during the fall, and in December the remaining struck sites ratified agreements, thus ending negotiations which involved some 3000 workers at some 20 plants. The companies, however, are not sure when there will be enough orders to start up, said one labor executive.

Some of the plants which settled earlier have returned to work but are operating well below capacity. The container industry in eastern Canada, 65% of which was shut down at one point by the strike, has lost considerable market share in recent months to U.S. producers, observers say. In addition, demand for boxes is seasonally weakest in the first quarter.

The new contracts are patterned after a settlement involving CIP Inc. facilities of 10%/9%/7% over three years, with adjustments among the various companies to achieve pay parity among various producers in the converting segment of the industry by 1985. MacMillan Bloedel Ltd.'s settlement was slightly lower, while Kruger Inc.'s and Domtar Inc.'s were somewhat higher.

Workers were unsuccessful in their goal of achieving pay parity with primary pulp and paper mills in eastern Canada where members of the same union won a 22% wage boost over two years in a contract settlement last spring.

- **Canadian Paperworkers Union members** voted down a proposal to merge with the Energy & Chemical Workers Union by 54% at a December convention, according to an observer. Union officials were unavailable for comment. Earlier in 1982, ECWU membership approved the merger.

EMPLOYMENT

Third-quarter mill wages jump 5%

Hourly wages of paper mill employees rose a hefty 5.1% in the third quarter from June levels, to $11.38/hour. Weekly hours worked also rose slightly during the quarter, bringing weekly paychecks to $506.41 before overtime, up 6.1% over June levels, according to Bureau of Labor Statistics data. In the meantime, overtime hours jumped from 5.7 hours/week to 7.0 hours.

For production workers at paperboard container and box plants, hourly wages also climbed—at a slower pace—in the third quarter. However, weekly hours worked declined slightly, bringing weekly paychecks to $340.25, up only 2.6% over June levels. Overtime hours also jumped at container and box plants—rising to 3.4 hours/week from 2.9 hours in June.

Production worker employment in the paper and allied products industry rose to 493,600 in September from its June low point of 489,000, but was still 6.3% below its year-earlier peak of 527,000 workers.

The total number of women workers in the paper and allied products industry continued to drop in the third quarter, although August levels of 152,500 were up slightly from the July trough of 151,900. The number of women workers has steadily declined since its peak of 165,000 workers in September 1981.

Average earnings and hours of production workers in the paper and allied products industry

	Sept. 1982	June 1982	% change for quarter	Sept. 1981	% change year ago
Paper & allied (SIC 26)					
Hourly earnings	$9.63	$9.27	3.9%	$8.95	7.6%
Weekly hours	41.7	42.0	−0.7	43.2	−3.5
Overtime hours	4.6	3.9	17.9	5.6	−17.9
Weekly earnings	401.57	389.35	3.1	386.64	3.9
Pulp & paper mills*					
Hourly earnings	$11.38	$10.82	5.2%	$10.63	7.1%
Weekly hours	44.5	44.1	0.9	46.6	−4.5
Overtime hours	7.0	5.7	22.8	8.9	−21.3
Weekly earnings	506.41	477.16	6.1	495.36	2.2
Paperboard containers & boxes					
Hourly earnings	$8.36	$8.13	2.8%	$7.67	9.0%
Weekly hours	40.7	40.8	−0.2	41.2	−1.2
Overtime hours	3.4	2.9	17.2	3.7	−8.1
Weekly earnings	340.25	331.70	2.6	316.00	7.7

*Does not include figures for paperboard mills, which are similar.
Source: Dept. of Labor, Bureau of Labor Statistics.

Executives' salaries up 15% in 1981

Top executives in the pulp, paper, paperboard and converted products industry posted an average 15% earnings increase in 1981, according to a new study of executive pay conducted by Arthur Young & Co. for the Financial Executives Institute. The 15% salary hike matched the 1980 increase for top paper industry executives and surpassed the 13% increase registered by U.S. executives in 27 major industries in 1981.

The New York, N.Y.-based consulting firm surveyed 33 paper products companies and found that top executives earned an average total compensation of about $150,420, ranking sixth among the 27 industry groups in the study. Chief executive officers at paper companies at all levels of sales volume were paid an average of $299,407, up 16% over 1980. Average earnings for other top paper industry executives were: top financial officer, $143,070, up 13%; top legal executive, $140,214, up 15%; top strategic planner, $103,239, up 7%; top human resources executive, $91,916, up 14%.

DOWNTIME

WFP to close Squamish pulp mill

Western Forest Products Ltd.'s 570-tpd bleached kraft pulp mill in Squamish, B.C., will be idled indefinitely starting Feb. 11 because of weak markets, said a company spokesman. A date for reopening the mill will be reviewed sometime in May, he said.

The mill, which came on-line in 1964, is inefficient to operate in the current competitive market, said the spokesman. It was also shut down for 21 days, Dec. 12 to Jan. 3.

Linerboard: Pickup in demand, limited capacity growth should help operating rates in recovery

Statistics	**1981**	**1982p**	**1983e**
Production, 000 tons	14,540	13,575	14,310
Capacity, 000 tons	15,372	15,928	16,063
Utilization rates	94.6%	85.2%	89.1%
Imports, 000 tons*	30	25	25
Exports, 000 tons*	1822	1800	1950
Apparent U.S. consumption			
000 tons	12,748	11,800	12,385
lb/capita	111.0	101.7	105.8
000 tons/$billion real GNP	8.48	8.01	8.18

p = preliminary e = estimate *Commerce Dept. data

Grade structure: Unbleached linerboard is made in a wide range of basis weights. The standard kraft liner is 42 lb/1000 ft^2, but other important grades are made in weights of 26, 33, 38, 69, and 90 lb. Major use is in domestic corrugated container production, although about 13% of output is exported. About 300,000 tons of recycled "test" liner is produced in the U.S. but is excluded from these figures.

Production/capacity: Unbleached liner production in 1982 dropped about 6.6% to 13.57 million tons, reflecting a 4.5% decline in corrugated box shipments, flat export demand, and inventory liquidation. Corrugated box shipments were depressed by the overall slump in U.S. industrial production and hit a four-year low of about 235 billion ft^2.

Export liner shipments continued to be hurt by the weak world economy and strong U.S. dollar, although at about 1.8 million tons, were only off 1.2%, after a 21.5% decline in 1981 from 1980's peak of 2.29 million tons.

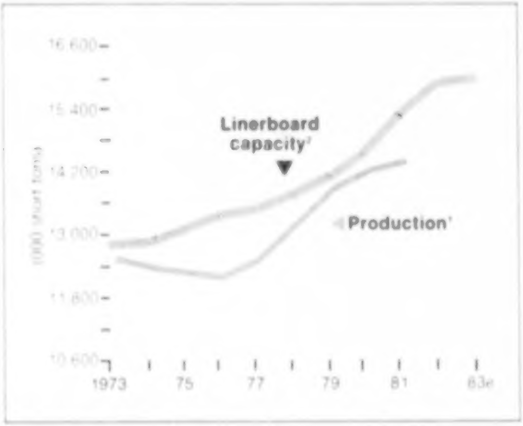
Containerboard inventories (both liner and corrugating medium) dropped from a high of 2.7 million tons at the beginning of 1982 to around 2.4 million tons at year end—a decline of roughly 300,000 tons—which was achieved by heavy production curtailments.

While liner production last year sank to its lowest level since 1978, capacity has continued to rise, causing operating rates to plunge from a high of 98.2% in 1979 to about 85% in 1982. Last year alone, capacity jumped 3.6%, reflecting the startup of two new machines in late 1981 and Weyerhaeuser's new machine at Valliant, Okla., in mid-1982.

Pricing: Price discounting erupted in the winter of 1981 and then occurred again in the late spring of 1982, as producers fought for market share in the face of weakening demand. By November the rebated price of 42-lb liner had eroded to $250/short ton and lower from its previous list of $300. (Year-end transaction prices have been as follows: 1981, $270/ton; 1980, $270/$300; 1979, $270; 1978, $220; 1977, $195; 1976, $210; 1975, $202.)

U.S. export prices in northern Europe began to erode in the fourth quarter of 1981 from a list price of $440/metric ton c.i.f. and by the end of 1982 had reached $280 to $300/metric ton and lower.

At current price levels, most U.S. linerboard mills are probably operating at a loss. This situation is discouraging new capacity additions and is also leading to the closure of some high-cost older facilities.



Estimated annual capacities of major U.S. companies are:

	Annual capacity[1] (000 tons)	Capacity share (%)
1. International Paper	1850	11.5
2. Weyerhaeuser	1390	8.7
3. Union Camp	1355	8.4
4. St. Regis Paper	930	5.8
5. Champion International	910	5.7
6. Container Corp. of America	745	4.6
7. Inland Container (Time)	735	4.5
8. Continental Forest Industries	705	4.4
9. Owens-Illinois	695	4.3
10. Great Northern Nekoosa	650	4.0
11. Westvaco	618	3.8
12. Stone Container	582	3.6
13. Packaging Corp. of America	565	3.5
14. Mead[2]	545	3.4
15. Willamette	520	3.2

Total U.S. capacity (1982): **16,063 million tons**
Capacity share of top 5 companies: 40.0%
Capacity share of top 10 companies: 62.0%

[1] Swing tonnage makes exact capacity estimates difficult.
[2] Includes 50% share in Georgia Kraft Corp., with all liner from the Phenix City, Ala., coated kraft board mill assigned to Inland Container.

Outlook: Linerboard production in 1983 is projected to rise 5.4% to 14.3 million tons, based on a 5.1% rise in corrugated box shipments, to around 247 billion ft^2, about an 8% rise in export shipments, and a further 100,000-ton reduction in containerboard stocks.

With only 0.8% capacity growth expected this year, operating rates should rise to around 89%.

With further improvement in demand and limited capacity additions in 1984 and 1985, operating rates for liner should be among the highest for any grade.

This will enable producers to raise prices rapidly and restore profitability.

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Capacity additions in 1983-85 lower than previously expected

Growth to be most pronounced in printing and writing papers, while newsprint increase slows—and construction capacity falls sharply

By DEBRA A. ADAMS, News Editor

☐ Capacity increases at U.S. paper and paperboard mills in 1982 were even less than had been expected when figures were adjusted downward last year, and this slowing trend will continue through 1985, according to American Paper Institute's latest capacity survey. Capacity for all grades of paper and board, excluding construction grades, rose to 70.2 million short tons in 1982—158,000 tons lower than estimated in last year's survey. The growth rate for 1981 to 1984 is down 0.3% from last year's figures to 2.1%.

Printing and writing papers capacity will expand the most during the 1983-85 period, at a rate of 3.3%/year. Smaller increases will occur in newsprint (2.0%), mechanical pulp (1.9%) and sulfate and soda pulp (1.7%). Declines in capacity are expected in construction paper and board (-1.4%) and pulp (-0.4%), packaging and industrial converting (-0.5%), and dissolving and special alpha pulp (-0.1%).

Paper and board capacity, including construction grades, is expected to go up just 1.7% annually over the next three years, reaching 73.8 million tpy in 1985, compared to a 2.2% average annual growth rate in a 15-year period from 1968 to 1982. Pulp capacity should rise by 1.5% from 1983 through 1985, compared to a 2.4% growth rate in the preceding 15 years.

Capital expenditures at pulp, paper and board mills and converting plants declined in 1982 from 1981 by

TABLE 1. **U.S. pulp and paper industry average annual capacity growth**

	1968-82	1983-85
Total paper/board	**2.4%**	**1.7%**
Total paper	**2.7**	**2.1**
Newsprint	4.4	2.0
Printing/writing	3.1	3.3
Packaging, industrial converting	0.6	(0.5)
Tissue	2.7	1.2
Total paperboard	**2.2**	**1.3**
Unbleached kraft	3.4	1.2
Solid bleached	1.7	0.5
Semichemical	2.8	1.6
Recycled	0.2	1.6
Total construction grades	**(1.0)**	**(1.4)**
Total woodpulp	**2.4**	**1.5**
Dissolving, special alpha	(0.1)	(0.1)
Sulfite	(2.7)	0.2
Sulfate and soda*	3.0	1.7
Semichemical	1.7	0.9
Mechanical	2.4	1.9
Pulp for construction grades	0.3	(0.4)

*Includes screenings

TABLE 2: **Paper/board annual capacity, 1982-85** *(000 short tons)*

	1982	1983	1984	1985
Total paper/board	**70,197**	**71,155**	**72,455**	**73,808**
Total paper	**34,695**	**35,427**	**36,280**	**36,944**
Newsprint	5,654	5,752	5,955	5,994
Printing/writing	17,827	18,468	19,052	19,647
Uncoated groundwood	1,742	1,747	1,749	1,749
Coated groundwood	3,312	3,625	3,686	3,741
Coated free-sheet	2,271	2,412	2,501	2,559
Uncoated free-sheet	8,937	9,049	9,439	9,900
Cotton fiber	152	158	159	100
Thin papers	373	374	374	374
Solid bleached bristols	1,039	1,103	1,154	1,163
Packaging & industrial converting	6,042	5,997	6,014	5,949
Unbleached kraft	3,987	3,932	3,928	3,880
Bleached packaging and industrial converting	608	612	612	600
Specialty packaging	531	528	532	524
Special industrial	916	924	941	945
Tissue	5,172	5,210	5,249	5,354
Total paperboard	**35,501**	**35,728**	**36,175**	**36,862**
Unbleached kraft	17,313	17,361	17,446	17,933
Kraft linerboard	15,928	16,063	16,157	16,642
Solid bleached	4,184	4,198	4,239	4,245
Semichemical	5,237	5,249	5,479	5,535
Recycled	8,731	8,920	9,011	9,149
Total construction paper/board	**3,305**	**3,183**	**3,167**	**3,169**

$300 million to $5 billion after posting a gain of $74 million in 1981 from the previous year. Total paper company spending was $6.3 billion in 1982, 6.6% less than in 1981 and 7.6% below the 1980 high.

Expenditures have remained relatively high, however, in view of the decline in the industry's total cash flow, which dropped to $3.1 billion compared to $4.3 billion in 1981 and $3.8 billion in 1980, said API senior vice president Norma Pace. By using creative financing, including safe harbor leasing and the sale of some assets, expenditures were maintained somewhat, she noted.

Newsprint growth falters

Unprecedented growth rates in newsprint over the last three years, boosting capacity by 35% or 1.5 million tons, will come to a sudden halt in 1983. Only one newsprint machine is scheduled to come on-line next year and capacity is expected to grow just 6% over the next three years to 5.9 million tons by 1985.

A glut of newsprint is expected through 1984 due to production overcapacity combined with a decline in consumption. The only U.S. machine scheduled to start up in 1983 is one at Augusta Newsprint Co.'s mill in Augusta, Ga. A number of newsprint projects which were slated to get underway in 1982 and later have been indefinitely delayed until market conditions improve.

Several older machines in Canada and the U.S. have been idled indefinitely or shut down permanently during 1982 due to increased competitive pressure. Much of this newsprint capacity should be removed from capacity totals during 1983.

Printing and writing papers capacity will grow at the fastest rate in the industry over the next three years. Uncoated free-sheet capacity will increase 1 million tons to 9.9 million tpy during 1983-85, including 114,000 tons which have been idle for several months. Coated groundwood and coated free-sheet capacity will be up 4.1%/year during the the next three years for a net increase of 429,000 tons and 288,000 tons, respectively, by 1985.

Recycled paperboard expanding

A marked improvement in growth is projected for recycled paperboard capacity, which is expected to increase 418,000 tons by 1985, representing a 1.6% annual growth in the 1983-85 period compared to a previous 12-year decline when machine shutdowns amounting to 2.5 million tons more than offset any gains in capacity.

Clay-coated news consumption has been fairly strong during the recession, and some observers feel that it captured some market share from solid bleached sulfate paperboard and will remain strong in the long term. An increase in recycled capacity, which observers have felt would be imminent considering the number of obsolete machines now operating, will likely be in clay-coated.

Just 61,000 tons of capacity is expected to be added in solid bleached paperboard during the next three years, bringing the total 1985 capacity to 4.2 million tons, according to API. International Paper Co., however, tentatively plans to raise SBS capacity by 150,000 tpy by 1985 in projects related to the company's mills in Pine Bluff, Ark., and Georgetown, S.C., though a 50,000-tpy expansion for Pine Bluff has not yet been approved.

An expected reduction in unbleached kraft paper capacity of 107,000 tons to 3.8 million tpy by 1985 is at-

TABLE 3: **Woodpulp annual capacity, 1982-85** *(000 short tons)*

	1982	1983	1984	1985
Total woodpulp	**57,803**	**58,064**	**59,208**	**60,448**
Dissolving	1,547	1,542	1,542	1,542
Chemical paper grades	44,030	44,321	45,039	46,226
Sulfite paper grades	1,797	1,785	1,804	1,810
Sulfate, soda paper grades	42,233	42,588	43,235	44,416
Bleached softwood*	12,023	12,258	12,739	13,137
Bleached hardwood*	8,688	8,861	9,090	9,533
Unbleached	21,523	21,437	21,406	21,746
Semichemical	4,768	4,641	4,866	4,904
Mechanical	5,780	5,904	6,015	6,120
Screenings	54	54	54	54
Total machine-dried pulp	**9,416**	**9,617**	**9,844**	**10,295**
Dissolving	1,547	1,542	1,542	1,542
Chemical paper grades	7,767	7,974	8,200	8,052
Sulfite	467	432	432	432
Sulfate	7,123	7,357	7,583	8,035
Unbleached sulfate	177	185	185	185
Other	102	102	102	102

*Includes semibleached

TABLE 4: **Market pulp capacity, 1982-85** *(000 short tons)*

	1982	1983	1984	1985
Total market pulp	**6951**	**7014**	**7208**	**7648**
Dissolving	1540	1534	1534	1534
Chemical paper grades	5401	5469	5663	6103
Sulfite	263	257	257	257
Sulfate	5138	5212	5406	5846
Bleached*	4989	5062	5254	5695
Unbleached	150	151	152	152
All other	10	10	10	10

*Includes semibleached

TABLE 5: **Mills and machines shut down, 1980-82***

	Machines	Mills	Annual capacity (000 short tons)
Paper			
Newsprint	—	—	—
Printing/writing	24 (1)	4	375 (39)
Packaging and industrial converting	18 (1)	6	283 (34)
Tissue	28	11	274
Paperboard			
Unbleached kraft	5 (2)	—	512 (280)
Bleached kraft	—	—	—
Semichemical	6	2	458
Recycled	19	9	519
Construction grades	67 (2)	45 (2)	1348 (34)
Total	**167 (6)**	**77 (2)**	**3769 (387)**

*Numbers in parentheses are shutdowns announced for 1983-85; not included in totals.

tributed to swings in machine time to kraft paperboard production as well as the shutdown of one machine.

Delays in capital expansion projects and the shutdown of machines in two southern mills will result in 1983-85 linerboard capacity additions amounting to only 620,000 tons, the lowest increase in any three-year period in the past decade.

Permanent shutdowns of machines totaling 286,000 tons is expected to slow the pace of growth in the semichemical paperboard market over the next three years. During that period capacity should rise 1.6% annually for a total gain of 262,000 tons compared to a 5.7% growth rate or 285,000 tons in 1982.

Conversion of felt-based roofing to fiberglass-based shingles has resulted in the elimination of 36 roofing mills with a combined capacity of 878,000 tons from total construction paper and board capacity. In 1983, capacity will fall 900,000 tons from 1981 levels to 3.2 million tons. Marginal further shutdowns are projected for 1983-85, but market observers say that based on the trend in the last three years, it would be hard for API accurately to forecast future conversion to fiberglass and its impact on construction grade capacity.

Major pulp additions in soda and sulfate

Pulp capacity will increase 2.7 million tons, reaching 58.8 million tpy in 1985, with sulfate and soda pulps accounting for over 80% of total woodpulp expansion during the next three years. While the annual growth rate for sulfate and soda pulps will be lower than in the previous 15 years—1.7% compared to 3%—capacity will rise by 2.2 million tons, to 44.1 million tons by 1985.

TMP additions will amount to just 17,000 tons in the period 1983-85, corresponding with the expected rate of decline in stone groundwood pulp. This contrasts with previous capacity increases in TMP, and reflects a reduction in the rate of growth in newsprint capacity.

Market pulp capacity will rise to 5.7 million tpy in 1985 by an expected 4.5% growth rate in bleached sulfate market paper grade pulp capacity over the next three years. At least 175,000 tpy of the 706,000-ton total increase is reportedly designated for the export market.

Wastepaper consumption is expected to increase over the next three years as a result of more mills substituting secondary fiber for virgin pulp. The proportion of secondary fiber used in papermaking is expected to increase to 56.2% in 1985 from 55.3% in 1981.

No shortages of paper stock are expected, however, because increases in wastepaper consumption should occur slowly, and collection systems in the U.S. are expected to readily absorb the gradual additional demand.

The 29 pulp, paper and paperboard projects planned in the period 1981-1985 are expected to increase the U.S. industry's annual capacity by 5 million tons by the mid-1980s. The bulk of these expansions occurred in 1981, providing 2.4 million tons of additional capacity. Just one project is planned for completion in 1985, and that will boost uncoated free-sheet capacity at Crown Zellerbach's Camas, Wash., mill by 160,000 tpy.

The South, which held a 51.1% share of paper/board capacity and 67.3% share of major pulp grades capacity in 1981, will continue to hold a predominant share of industry capacity. During 1983-85, 59.6% of total paper/board capacity increases and 87.6% of new woodpulp capacity growth will be in the South. □

TABLE 6: **Announced major capacity additions**

Company	Location	Grade	Annual capacity
Mead	Escanaba, Mich.	Coated groundwood	200
Portals	Hawkinsville, Ga.	Cotton fiber	3
St. Regis	Sartell, Minn.	Coated groundwood	170
Weyerhaeuser	Columbus, Miss.	Coated groundwood	175
Weyerhaeuser	Valliant, Okla.	Unbl. kraft liner	200
Wisconsin Tissue	Menasha, Wis.	Tissue	65*
1983			
Augusta Newsprint	Augusta, Ga.	Newsprint	225
MacMillan Bloedel	Pine Hill, Ala.	Semichem. paperbd.	210
Scott Paper	Skowhegan, Maine**	Coated free-sheet	200
1984			
Champion	Courtland, Ala.	Uncoated free-sheet	150
Independent Kraft	Tuscaloosa, Ala.	Unbl. kraft liner	280
Leaf River	New Augusta, Miss.	Bleached kraft pulp	355
Union Camp	Eastover, S.C.	Uncoated free-sheet	215
1985			
Crown Zellerbach	Camas, Wash	Uncoated free-sheet	160

*Will replace existing facilities; net increases not announced.
**Started up Dec. 12, 1982.

Reduced caustic demand keeps prices low

By BARRY SHOCKETT

Although there was a slight improvement in the fortunes of the U.S. pulp and paper industry in the second half of 1982, total output for the year was down an estimated 4.5% over 1981.

The chloralkali industry was severely depressed, averaging no more than a 60% operating rate (chlorine basis) for the year, leading to several plant closures.

Pulp and paper output in Canada dropped to a greater extent. At the ten-month mark in 1982, pulp production was down 10%, while total paper output was off almost 8% over 1981 levels. Paperboard production, which was affected by a lengthy strike in eastern Canada at corrugated carton plants, was 16% below 1981.

Caustic demand by pulp mills was down between 5% and 6% reflected in the reduced mill operating rate of 77% for the January-October period, compared with 87% in the 1981 period.

U.S. statistics, sodium hydroxide (000 short tons)

	1979	1980	1981	1982e
Capacity (est)	14,480	14,500	14,600	15,100
Production	12,759	11,625	10,648	9,500
Imports	183.5	132	246	400
Exports	1484.5	1413	1330	800
Apparent consumption	11,458	10.344	9564	9100

Source: Bureau of Census, U.S. Dept. of Commerce

Canadian statistics, sodium hydroxide (000 short tons)

	1979	1980	1981	1982
Capacity	1504	1896	1908	1975
Production	1254	1608	1606.5	1576
Imports	378.5	249	238	220.5
Exports	68.5	101.5	156.5	220.5
Apparent consumption	1564	1755.5	1688	1576
Pulp and paper	971	1,030	990.5	935

CAUSTIC SODA

UNITED STATES

Uses: Most of the sodium hydroxide (NaOH) consumed by the pulp and paper industry is purchased by kraft and bleached sulfite pulp mills, the major application being for caustic extraction. Other important uses include organic and inorganic chemicals production, textiles, and aluminum processing.

Demand: The sluggish economy resulted in a reduced caustic consumption by the pulp mills in 1982 of an estimated 1.7 million tons (almost 18% of the estimated 9.5 million tons produced). Mill usage in 1981 was reported to be an estimated 1.9 million tons out of a total caustic production of 10.65 million tons. Imports increased to 400,000 tons in 1982, with 75% coming from Canada.

Sources: Caustic is a coproduct of chlorine production. Producers are listed in the January issue of PULP & PAPER, p. 207. There were several closures in 1982.

Availability: There were no supply problems in 1982, and none are expected in the first half of 1983. 1982, tight to market; 1981, very tight to tight; 1980, very tight; 1979, market; 1978, market.

Pricing: Some producers dropped caustic list prices to conform more with market price. At the beginning of1983, a new list price, $240/ton f.o.b. Gulf Coast area, went into effect. Higher listings prevail elsewhere. In New Jersey, Maryland, and Ohio, the new list price is $270/ton, and in northern New York state and Michigan it is $275/ton. The list price is $290/ton in the Pacific Northwest. Pricing history (list price): 1982, $315/ton (50% solution, f.o.b. works, freight equalized); 1981, $270-$320/ton; 1980, $167-$200/ton; 1979, $130-$160/ton; 1978, $160-$170/ton.

Forecast: The return to the 1981 caustic demand level by pulp mills in 1983 will probably not occur as previously predicted. Pulp mills will require about 1.8 million tons this year. Prices will remain depressed in the first half of the year, but could rise 10% or 15% on average for all of 1983.

CANADA

Uses: Pulp mills, which consume by far the largest share of the caustic soda produced, employ the sodium hydroxide for the extraction stages in kraft bleach plants, for hypochlorite makeup, and in sulfite pulping. The next-largest end-use areas are in the production of alumina and propylene oxide.

Demand: In 1982, pulp mills consumed about 935,000 tons of caustic (59.5% of total demand), of which 694,000 tons were used in bleaching. In 1981, 990,000 tons were used by pulp mills overall, with bleaching applications consuming an estimated 714,000 tons.

Sources: Caustic is a coproduct of chlorine, and is made by nine firms in Canada. Producers are listed in P&P, January, p.207.

Availability: Although exports increased 40% in 1982, there is sufficient capacity to meet any domestic requirements. 1982, tight to market; 1981, very tight to tight; 1980, very tight; 1979, tight; 1978, tight.

Pricing: Although chlorine prices rose 9.5% as of January 1, 1983, caustic soda list prices remain steady at C$417/ton since April 1, 1982. Prices are not expected to increase before the second quarter. Pricing history is as follows: 1982, C$381-C$417/ton (50% solution, f.o.b. works, freight equalized): 1981, C$293-C$381/ton; 1980, C$195-$293/ton; 1979, C$183-C$195/ton; 1978, C$175-C$183.

Forecast: A 10% boost in caustic soda list prices could occur by April. Paper industry caustic demand is expected to increase an average of 2%/year to mid-decade.

Mr. Shockett is consulting editor-chemical markets for PULP & PAPER.

PULP & PAPER

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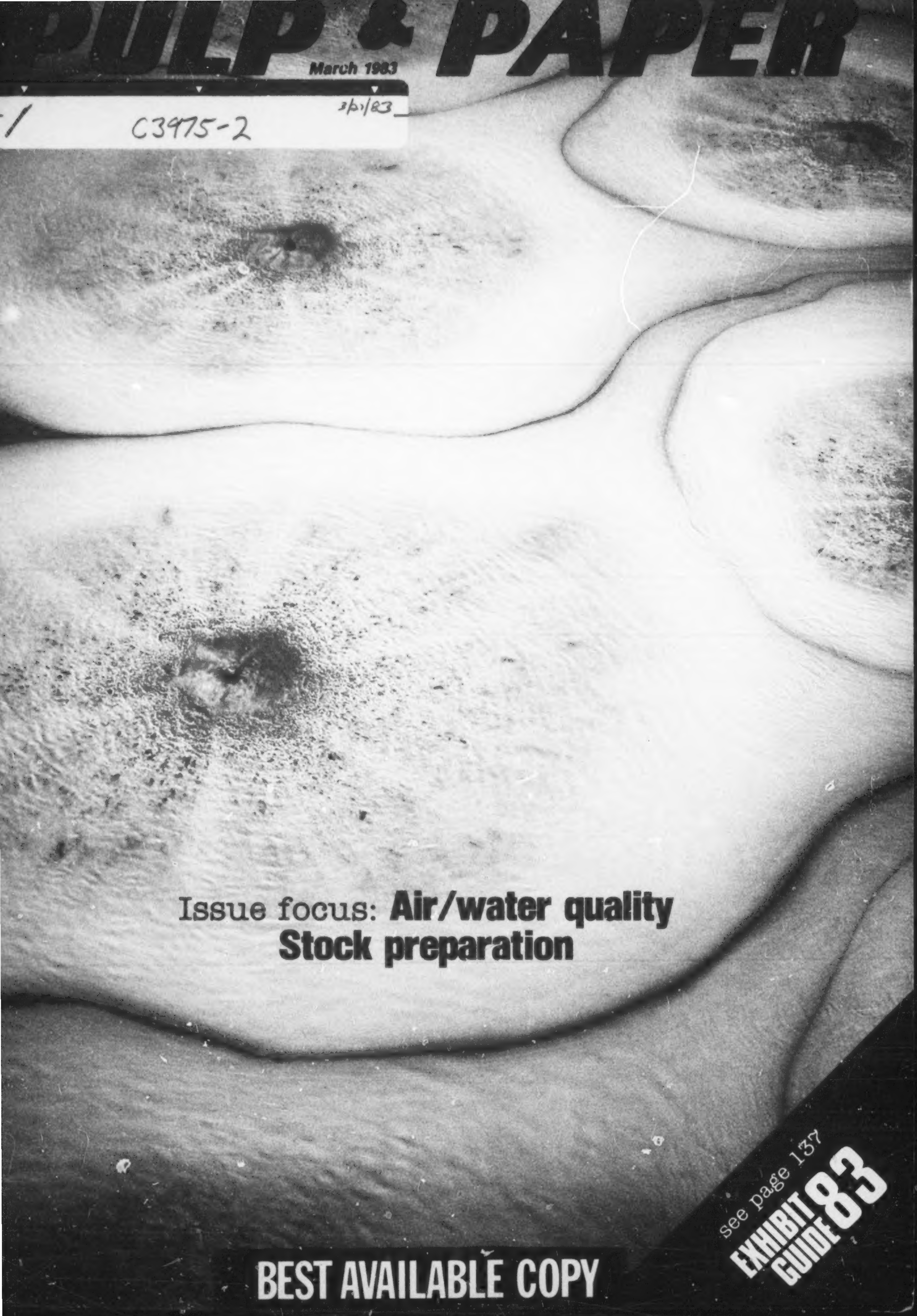

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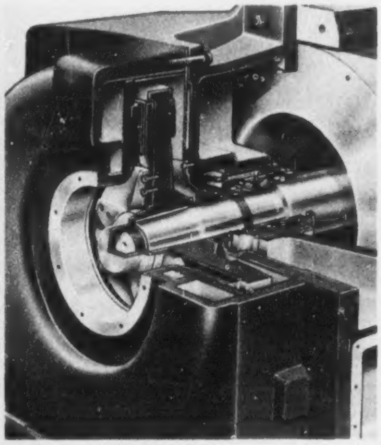

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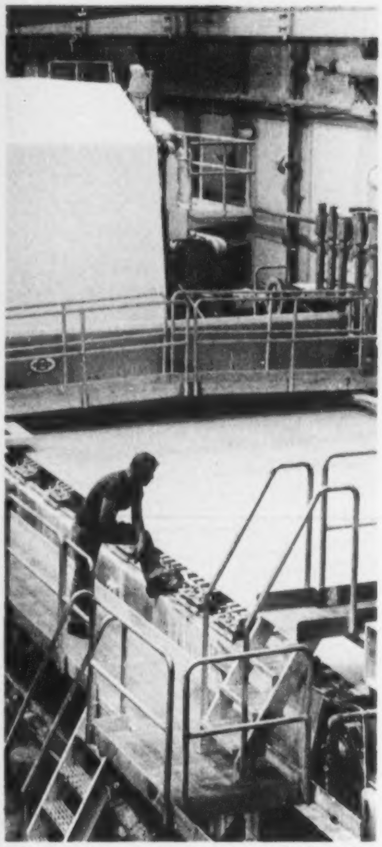

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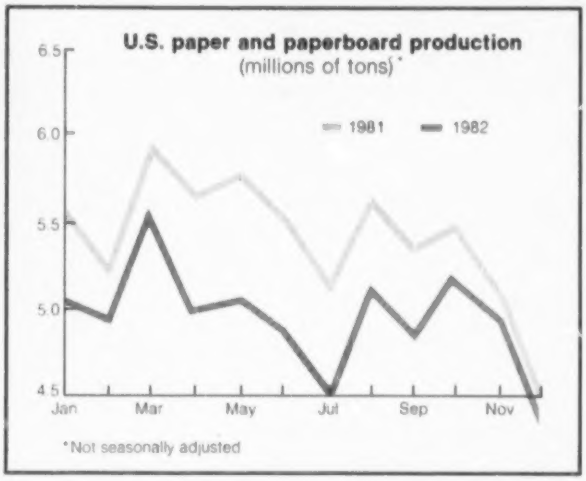
MONTH IN STATISTICS

U.S. paper and paperboard production in December totaled 4.3 million short tons, 0.4% below the December 1981 total, according to the American Paper Institute. The production trend, as measured by the two-month moving average of the seasonally adjusted data, was below the 60-million-tpy level for the first time since August. For the year, total production came to 59.4 million tons, 4.3% below the 1981 total.

Among major grades, uncoated groundwood and free-sheet grades topped year-earlier output levels in December, as did unbleached kraft packaging and industrial grades. Coated paper output continued strong in December, and for the year came to 5.03 million tons, up 1.9% over 1981. Total paper production for the year totaled 30.2 million tons, down 2.3% from 1981. Paperboard production continued its slowdown in December, and for the year came to 29.3 million tons, down 6.3% from 1981.

Total Canadian newsprint shipments in December came to 717,000 metric tons, down 10.4% from December 1981, according to the Canadian Pulp & Paper Assn. Newsprint mill operating rates fell to 71% from 80% in November, and were well below the 96% rate of a year earlier.


U.S. paper and paperboard production
(millions of tons)*

*Not seasonally adjusted

		Latest month (000 short tons)	% change from year ago	Annualized year-to-date (000 short tons)	% change from year ago
PAPER & PAPERBOARD PRODUCTION[1]					
Newsprint	December	363	−8.1	5,041	−3.6
Uncoated groundwood (s)	December	118	3.5	1,452	−0.8
Coated paper (s)	December	399	2.3	5,032	1.9
Uncoated free sheet (s)	December	598	4.0	7,837	−0.8
Unbleached kraft packaging and industrial (s)	December	270	3.8	3,530	−5.2
Tissue	December	345	−2.5	4,388	−2.9
Total paper	**December**	**2,290**	**−1.3**	**30,169**	**−2.3**
Kraft linerboard, unbleached	December	915	0.5	13,589	−6.5
Semichemical medium	December	328	3.8	4,381	−7.2
Bleached paperboard	December	268	0.8	3,682	−5.8
Recycled paperboard	December	464	0.2	6,953	−5.8
Total paperboard	**December**	**2,035**	**0.7**	**29,275**	**−6.3**
Total paper and paperboard*	**December**	**4,325**	**−0.4**	**59,444**	**−4.3**
PULP, WASTEPAPER & FIBER[2]					
Total woodpulp production	November	4,211	−1.8	49,979	−5.4
Market pulp production	November	512	−5.4	5,798	−8.2
Wastepaper consumption at paper/board mills	November	1,108	−9.6	13,631	−3.0
Pulpwood consumption (cords)	December	6,789	5.1	79,483	−1.2
CONVERTED PRODUCTS STATISTICS[3]					
Corrugated box shipments (billion ft^2)	December	17.540	−0.3	234.918†	−4.2
Containerboard inventories at box plants	Dec. 1	2,524	−2.9		
INTERNATIONAL TRADE[2]					
U.S. paper imports (including products)	November	722	−1.4	8,092	−3.6
Imports of Canadian newsprint	November	566	−8.7	6,531†	−6.1
U.S. paper exports (including products)	November	308	−11.2	4,257	−9.3
Exports of unbleached kraft linerboard	December	136	18.3	1,871	−0.8
Exports of woodpulp	November	247	−7.5	3,392	−7.5
CANADIAN STATISTICS[4] (reported in metric tons)					
Total newsprint shipments	December	717	−10.4	8,045†	−9.8
Operating rates	December	71%	96%	82%	94%
Inventories held by U.S. consumers	Dec. 31	1,252	−15.2		
Woodpulp shipments (export only)	December	513	−8.1	5,824†	−11.7
Operating rates	December	62%	82%	75%	86%

1. American Paper Institute. 2. API, Bureau of Census, American Pulpwood Assn. 3. Fiber Box Assn., Paperboard Packaging Council. 4. Canadian Pulp & Paper Assn.
*Includes construction and wet machine grades. †Not annualized. ‡Not directly comparable to year ago because of coding change. (s) = shipments.

FINANCE

U.S. paper profits plummet in fourth quarter

U.S. pulp and paper companies continued to be battered by the recession in the fourth quarter of 1982, as prices remained weak and shipment volumes in most product lines to both domestic and international markets remained below year-earlier levels. Paper companies' earnings tumbled 84% below already-depressed fourth-quarter 1981 levels on a 4.5% decline in sales, according to a PULP & PAPER survey of 21 firms.

Firms with extensive forest products holdings were harder hit: seven firms saw fourth-quarter profits fall 91% on a 0.8% rise in sales. Fourth-quarter earnings for the total paper/forest products industry were down 86% on a 2.5% decline in sales.

Full-year paper industry earnings for the 21 companies were down 46% while forest products earnings for seven firms dropped 65%, bringing the year's earnings for the entire paper/forest products industry down 51%.

IP profits slide. International Paper Co.'s operating net came to $143.6 million, down 46% from full-year 1981. "In 1982 the forest products industry faced the worst overall business environment since the 1930s," said Edwin A. Gee, IP chairman and CEO. "Profits in our wood products and paper businesses suffered seriously. As the year progressed with no improvement, price competition intensified. The pricing environment was particularly severe in the containerboard, pulp, and white paper segments."

Crown Zellerbach Corp. posted a $21.4-million loss from operations for the fourth quarter caused primarily by production curtailments. On top of the loss, CZ also reported a net charge of $125 million from the sale of Crown Zellerbach Canada Ltd. and the restructuring of domestic operations. Full-year earnings were 78% below 1981. Mead Corp. also reported a loss from operations for the quarter—as well as a loss for the full year—due to costs and interest expenses associated with mill expansions. Not included in Mead's figures is an extraordinary charge of $24 million in 1982 for settlement of a corrugated container antitrust suit.

Among major tissue producers, both Kimberly-Clark Corp. and Scott Paper Co. saw fourth-quarther earnings plummet due to the Mexican peso devaluation which diluted earnings from Mexican affiliates. An addition, a strike at the Scott Maritimes pulp mill in Nova Scotia contributed to Scott's earnings falloff.

Wood products hit trough. Despite a brief pickup in December lumber and plywood markets, fourth-quarter earnings for seven major forest products companies were hurt by the double impact of a continuing decline in wood products operations and a sharp falloff in major pulp, paper, and packaging operations. Boise Cascade reported fourth-quarter profits down 80%, full-year profits down 94% from 1981 levels.

Georgia-Pacific Corp. and Weyerhaeuser Co. both took extraordinary charges against 1982 earnings of $56 million and $21.9 million, respectively, for the settlement of plywood antitrust litigation. The charge caused G-P to post a $43-million loss in the fourth quarter and brought full-year earnings 68% below 1981.

Canadian firms in red. Plummeting prices and demand, particularly for pulp and newsprint, caused most Canadian pulp and paper companies to post substantial losses for the fourth quarter—and several for the full year as well. Wood products markets remained stagnant throughout 1982, but did pick up slightly at the very end of the year.

Six firms reporting showed a combined loss of $24 million for the quarter and $19 million for the year. Fourth-quarter sales for the firms were 8% below year-earlier levels, while full-year sales dropped 6%.

U.S. PAPER/FOREST PRODUCTS RESULTS

	Full Year ($000)			
Paper companies	**Sales**	**Change 1982/81**	**Earnings[1]**	**Change 1982/81**
Chesapeake	$239,900	−15.1%	$8,100	−69.1%
Clevepak	150,195[2]	26.8	4,332[2]	6.3
Consolidated	530,296	−1.2	44,998	−17.7
Crown Zellerbach	2,947,400	−6.4	12,800[3]	−78.3
Federal Paper	509,987	−2.0	16,065	−48.3
Fort Howard	537,030	14.0	92,400	11.3
Glatfelter	247,403	−6.8	19,890	20.5
GN Nekoosa	1,429,700	−4.2	74,500	−21.2
Hammermill	1,395,950	−0.3	30,262	−35.1
Intl. Paper	4,015,200	−19.4	143,600	−45.9
Kimberly-Clark	2,946,100	2.1	197,400	−3.6
Longview (10/31)[4]	371,463	−4.6	3,559	−73.2
Mead	2,666,500	−8.0	(61,784)	n.m.
Mosinee	84,957	−6.5	3,964	−42.7
Pentair	271,085	21.0	10,510	28.9
St. Regis	2,555,949	−9.3	45,028	−74.5
Scott	2,293,436	−0.7	74,457	−44.2
Sonoco	542,492	1.7	28,587	−25.7
SW Forest	582,745	−25.2	(27,389)	n.m.
Union Camp	1,526,014	−8.4	124,021	−26.6
Westvaco	1,449,664	−6.5	63,093	−37.4
Willamette	928,745	−4.8	5,345	−81.3
Total	**28,222,211**	**−7.0**	**913,738**	**−45.7**
Forest products				
Boise Cascade	2,912,450	−6.3	7,250	−94.0
Champion Intl.	3,737,378	−6.7	39,650	−66.9
Georgia-Pacific	5,402,000	−0.2	52,000	−67.5
Louisiana-Pacific	872,190	−14.7	(16,650)	n.m.
Pope & Talbot	257,715	9.1	4,327	59.6
Potlatch	820,180	−6.8	22,533	−41.6
Weyerhaeuser	4,186,224	−7.0	140,016	−40.3
Total	**18,188,137**	**−5.1**	**249,126**	**−64.5**
U.S. total	**46,410,348**	**−6.3**	**1,162,864**	**−51.3**

CANADIAN PAPER INDUSTRY RESULTS

B.C. Resources	C$799,200	−1.9	(61,000)	n.m.
Con-Bathurst	1,424,000	−3.7	53,406	−47.5
CZ Canada	654,700	0.2	(23,300)	n.m.
Domtar	1,686,600	−4.4	9,100	−84.7
Great Lakes	437,854	−23.0	18,552	−77.1
Weldwood	415,201	−13.7	(15,919)	n.m.
Total	**5,417,555**	**−6.0**	**(19,161)**	**n.m.**

1. Income after taxes, from continuing operations, excluding most significant nonrecurring items in both years.
2. Includes results from Torin Corp., acquired July 4, 1982.
3. Does not include net after-tax charge against 1982 earnings of $215 million from sale of Crown Zellerbach Canada and restructuring domestic operations.
4. Period ended. ( ) = loss. n.m. = not meaningful.

Tissue: Higher production, limited capacity growth should lift operating rates in 1983

Statistics	**1981**	**1982**	**1983e**
Production, 000 tons[1]	4518	4388	4530
Capacity, 000 tons[1]	5035	5172	5210
Utilization rates, %	89.7	84.8	86.9
Imports, 000 tons[2]	7	7	7
Exports, 000 tons[2]	52	24	32
Apparent U.S. consumption			
000 tons	4473	4371	4505
lb/capita	38.9	37.7	38.4
000 tons/$ billion real GNP	2.98	2.96	2.98

[1] API data [2] Commerce Dept. data

Grade structure: Tissue is composed of two major classes—sanitary and "other." Sanitary tissue includes facial tissue, paper napkins, bathroom tissue, toweling, and basestock for sanitary stock, wadding, and wipers. "Other" includes basestock for waxing, wrapping, and miscellaneous tissue. Sanitary tissue can be further divided into consumer and commercial/industrial grades. Typical basis weights for single-ply toilet tissue are 12 to 14 lb/3000 ft², and for single-ply towel, 32 to 39 lb/3000 ft².

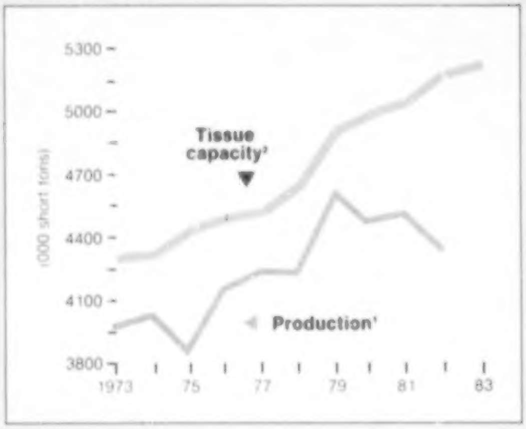
Production/capacity: Tissue production has seesawed through the recession, with tonnage falling 2.9% in 1980, then recovering 3.2% in 1981, and then falling 2.9% in 1982, to 4.39 million tons. Unit volume last year probably performed somewhat better, reflecting a shift to single-ply products as well as lower sheet counts per roll.

While tissue production declined during the 1980-82 period, capacity grew at about a 2.0%/year pace. This reflected the addition of six new tissue machines, which was only partly offset by the shutdown of 28 older, less efficient machines. The result has been a decline in operating rates from 92.5% in 1979 to 84.8% in 1982.

Slack market conditions plus the sharp decline in fiber costs have led to pricing competition. Consumer tissue prices were raised by 2% to 5% in March 1980 and then again by 7% in September 1981, but part of these increases may have been eroded by promotional discounting. Consumers in the early stages of the recession tended to trade down to lower price and performance products, although last year there were indications that the growth in market share of generics and private label products had begun to slow.

Competition has been even more fierce in the smaller commercial/industrial sector of the market, where demand has fallen (due to employee layoffs, lower hotel occupancy rates, etc.), wastepaper costs have dropped sharply, and capacity has either been added or redirected from consumer grades.

Outlook: Tissue production in 1983 is forecast to rise about 3.2%, to 4.53 million tons, and unit shipments will probably jump even more sharply, with improvement in the economy and continued population growth. Capacity is projected to rise by only 0.7% this year, resulting in an operating rate of about 87%. With the startup of a new machine at Wisconsin Tissue Mills last fall, not a single new machine is definitely scheduled to come online in the U.S. over the 1983-85 period (although Fort Howard is studying a fourth unit for its Muskogee, Okla., mill). In addition, an idle "advanced technology" machine at Scott Paper's Everett, Wash., mill, and a temporarily closed air-forming line at Kimberly-Clark's New Milford, Conn., facility may be reactivated.



Estimated capacities of major U.S. companies are:

	Annual capacity (000 tons)	**Capacity share** (%)
1. Scott Paper Co.	1035	19.9
2. Procter & Gamble Co.	900	17.2
3. Fort Howard Paper Co.	565	10.8
4. Georgia-Pacific Co.	500	9.6
5. James River Corp.	435	8.3
6. Kimberly-Clark Corp.	400	7.7
7. Crown Zellerbach Corp.	310	6.0
8. Potlatch Corp.	120	2.3
9. Marcal Paper Mills Inc.	115	2.2
10. Diamond International Corp.	102	2.0
11. APL Corp.	95	1.8
12. Wisconsin Tissue Mills Inc.	90	1.7

U.S. annual capacity (1983): **5.210 million tons**
Capacity share of top five companies: 65.9%
Capacity share of top ten companies: 86.0%

With a continued production improvement and capacity growth of 1.2% next year, operating rates should improve to 90% to 91% in 1984. This should lead to a rebound in industry pricing and profits beginning this year and accelerating in 1984.

Pricing: The producer price index for all converted sanitary tissue products has shown the following trend (year-end; 1967 = 100): 1970, 115.1; 1972, 121.0; 1974, 155.7; 1975, 194.7; 1976, 214.7; 1977, 236.7; 1978, 253.3; 1979, 279.4; 1980, 343.4; 1981, 349.2; 1982, 362.6. Based on the index, prices at the end of 1982 were only 3.6% higher than a year ago, which in turn were only 1.9% above the end of 1980.

Market: End uses for tissue papers are: 38% toilet (of which 54% consisted of single-ply and 46% of multi-ply); 31% towels; 8% facial tissue; 13% napkins; 2% wipes; 5% other sanitary; and 3% nonsanitary. Nonsanitary tissue production has dropped about 37% over the past five years, to 136,000 tons in 1981, partly reflecting inroads from plastic films in such markets as waxing paper.

Bear Island dewatering 100% TMP sludge, burning in boiler

Sludge at Doswell, Va., mill is thickened by Hydrasieve, dewatered by belt filter press to 30% solids, mixed with bark, and blown to hog fuel boiler

By T.R. HEWITT and ROBERT ELLIS

☐ Bear Island Paper Co. at Doswell, Va., is a 500-tpd newsprint mill utilizing a furnish of 100% thermomechanical pulp (TMP). The mill uses Virginia and loblolly pine as its pulpwood source.

Mill effluent at Bear Island is collected in a single sewer and receives primary and secondary treatment. Primary clarification produces a sludge that is very dissimilar from kraft mill sludges.

This article describes a sludge treatment and dewatering testing program and study that was conducted by J.E. Sirrine Co. for Bear Island in 1980 to determine the optimum method for the mill to handle its sludge.

At the time of the study, Bear Island was unable to dewater and dispose of all of the primary and secondary sludge being produced in the treatment process using existing equipment. The sludge treatment system consisted of two belt-filter presses receiving a 1%-solids slurry. Excess sludge was being directed to an emergency holding basin that was quickly being filled. Three goals were established for the study as requirements for the waste treatment system to operate economically:

1. Identify the most cost-effective sludge treatment method
2. Identify the most cost-effective sludge disposal method
3. Eliminate diversion of sludge to emergency basin.

At the time, no information was available on previous mill experience with 100% TMP sludge. Thus, various methods of thickening and dewatering the sludge were pilot tested to provide the information needed to make an evaluation and to meet these goals.

TABLE 1: **Summary of thickening performance results**

Method	Thickened sludge solids[1]	Polymer dose	Capture (%)
Hydrasieve	2.6%	16.5 lb/ton[2]	86
Centrifuge	4%-7%	8.8 lb/ton	93
Rotary screen thickener[3]	2%-3%	6.6-13.2 lb/ton	98
Dissolved air flotation	2%-3%	4.4 lb/ton	N.a.

Notes:
1. Sludge feed varied from 0.8% to 1.1% solids
2. Rough estimate
3. Estimated from bench scale tests
N.a. Not available

Sludge characterization

The sludge generated in treating TMP mill effluent is a low-solids slurry that is high in fines content and quite difficult to dewater. The 1% to 2% primary clarifier underflow slurry is like waste biological sludge in some respects. The effect of fiber presence in the sludge is not apparent until the solids content reaches about 5% to 6%.

The most notable feature of TMP wastewater sludge is its fineness. Samples analyzed at the mill showed that about 75% to 85% of its solids passed through a No. 200 sieve. The solids consist of fines and short-length fibers with very high specific surface. The short fiber (averaging 1.0 to 1.2 mm) is less effective in forming a mat during dewatering. Its high specific surface impedes consolidation of solids in the clarifier. Fines are generated in the TMP refining process and build up because of low first-pass retention on the newsprint machine. One large source of fines is the discharge of fourth-stage cleaner rejects. Another source is press pan effluent.

Solids in the primary clarifier underflow are poorly consolidated because the TMP process produces highly refined fibers that are saturated with water and have a very low settling velocity. Therefore, gravity clarification, while effective in providing suitable quality overflow, provides low-solids underflow. Gravitational forces are inadequate to force water from between sludge particles.

The high solids content of the raw wastewater causes a hindered settling condition in the clarifier. The clarifier acts more as a thickener because the raw wastewater

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contains 2000 to 4500 mg/l total suspended solids (TSS) on the average. The mill's primary clarifier is loaded at less than 300 gal/day/ft², which is about half the typical design value for kraft wastewater primary clarifiers.

The low solids content in the primary clarifier underflow makes the sludge more difficult to dewater, and additional sludge dewatering equipment is needed. During the equipment-testing period, the underflow solids ranged from 0.8% to 1.2% solids. Since that time, operating experience, clarifier modifications, and polymer addition have allowed improvement in underflow solids to between 1.5% and 2.0%. This is still notably lower than the range of 2.5% to 5.0% solids obtained from kraft wastewater primary clarifiers.

Another unusual feature of TMP sludge is its high organic content. Since pulping chemicals and fillers are not used at this mill, the sludge solids are about 92% volatile. The high organic content suggests high energy content, and the average of samples taken on five consecutive days showed a Btu content of 9227/lb of dry sludge.

Due to high energy and low ash content of the sludge, burning dewatered sludge in the hog fuel boiler was established as the desired disposal option. Analysis of the sludge ash by the Environmental Protection Agency toxicity procedure indicated that the ash is nonhazardous.

The primary TMP sludge is similar in nature to waste biological sludge, particularly in the dilute 1%- to 2%-solids condition. The treatment plant's waste biological sludge amounts to only about 10% of total solids, and no method for easily controlling the mixture of the two was available, so only primary sludge was used in all tests. The expectation was that the small quantity of biological sludge and its similarity in nature to TMP sludge would result in minimal impact on equipment performance.

Thickening tests

Because the primary clarifier underflow solids content was very low and the nature of the sludge made it difficult to dewater, thickening the sludge prior to dewatering was thought to be important. Four methods of thickening were tested: Hydrasieve, centrifuge, rotary screen thickener, and dissolved air flotation (DAF). Table 1 summarizes the performance of each thickening process.

Hydrasieve tests were made on a full-size (6-ft-wide) unit installed ahead of one of the existing belt presses. The unit was loaded at approximately 340 gpm with polymer-conditioned sludge. Precise determination of the polymer dosage could not be made, but it was estimated at about 15 lb/ton of dry solids. The polymer dosage was set so that large flocs formed in the headbox and clumps of thickened sludge rolled off of the base of the screen.

The Hydrasieve provides acceptable thickening for extremely low installed and maintenance costs, but with a high polymer requirement. An advantage of the Hydrasieve is that it can easily be mounted to feed dewatering equipment directly, thus eliminating the need to repump thickened sludge and add more polymer.

The centrifuge tests were made on production-size, solid-bowl-type centrifuges of both high- and low-speed design. The capture rate of the centrifuge was greatly affected by polymer dosage. Capture ranged from 80% at 4.5 lb/ton of polymer to 99% at 10 lb/ton. Cake solids content was not affected much by polymer dosage. The optimum operating condition was determined to be about 7 lb/ton of polymer, where a capture rate of about 85% was obtained. Cake solids can be controlled in the range of 4% to 7% by varying the bowl speed and pond depth.

Bench scale screen tests indicated that the rotary screen thickener would require 6 to 12 lb/ton of polymer to produce thickened sludge at 2% to 3% solids. Full-scale testing apparatus was not available for this equipment, so performance could not be confirmed.

Of the four thickening methods tested, only DAF provided no significant advantage over existing methods. On-site pilot testing showed that sludge could be thickened from 0.8% solids to 2.1% solids using DAF. The DAF system manufacturer indicated that the process could reach 3% solids in full-scale generation by using the skimmer mechanism (not included in pilot test) to optimize the system. The DAF unit manufacturer also tested the unit on raw wastewater to assess its suitability for primary solids removal. The conclusion was that DAF required polymer addition to obtain roughly the same results as gravity clarification without polymer.

Dewatering tests

Dewatering tests were performed on both thickened and unthickened sludge, as appropriate, to determine the maximum obtainable solids content. Five types of equipment were tested: vacuum filter, centrifuge, belt-filter press, diaphragm press, and V-press. The predicted opti-

TABLE 2: **Summary of pilot test results**

Equipment	Sludge	Maximum cake solids
Vacuum filter	Unthickened	22%
Centrifuge	Unthickened	19%
Belt filter press	Unthickened	36%
Diaphragm press	Unthickened	45%
Diaphragm press	Thickened	47%
V-press	Dewatered	33%

TABLE 3: **Dewatering system cost summary**

Combination	Hydrasieve/ belt filter press	Hydrasieve/ belt filter press and V-press	Centrifuge/ belt filter press	Centrifuge/ diaphragm press
Installed cost	$4,150,000	$4,850,000	$5,800,000	$10,000,000
Annual costs				
Power	18,000	54,000	105,000	104,000
Polymer	463,000	463,000	216,000	216,000
Maintenance	55,000	64,000	88,000	265,000
Operating labor	150,000	150,000	150,000	227,000
Ash disposal	17,000	17,000	17,000	17,000
Sludge fuel credit	(366,000)	(389,000)	(366,000)	(437,000)
Total annual cost	**$ 337,000**	**$ 359,000**	**$ 210,000**	**$ 392,000**

Notes:
1. Installed cost includes equipment for conveying dewatered sludge to boiler area and feeding it to boiler. Operating costs are also included.
2. All costs are escalated to 1982 dollars from 1980 dollars using a 10%/yr escalation factor.
3. Total annual costs do not include depreciation or amortization of equipment.

mum dewatering performance of each piece of equipment is summarized in Table 2.

The important factor in selecting dewatering equipment is how economically it can be applied. Equipment manufacturers determine the performance level and operating parameters that, in turn, determine equipment sizing. The results of this evaluation and manufacturers' expected operating performance conditions are discussed below. Performance and application data were used in the economic analysis of the equipment.

Vacuum filter. The cake formed in the vacuum filter leaf tests proved to be too thin for vacuum filtration to be applicable to TMP sludge. Cakes on the order of $^1/_{16}$-in. thick were formed, and the manufacturer indicated that this cake would not discharge from the filter media. The apparent problem was that fines in the sludge packed too tightly to allow the vacuum to draw additional solids to the filter cloth.

Centrifuge. Dewatering tests were performed on both high- and low-speed design solid-bowl centrifuges. In the high-speed tests, dewatered sludge in the range of 16% to 19% solids was obtained using 15 to 28 lb/ton of polymer. Less than 60% capture was achieved in these test runs. Sludge cakes of 10% to 12% solids could be achieved using 8 to 12 lb/ton of polymer and obtaining 90% capture. This was deemed to be the optimum operating conditions by the centrifuge manufacturer.

In the low-speed centrifuge tests, dewatered sludge of 10% solids was obtained using 13 lb/ton of polymer; capture rate was 95%+. Experience shows that minimum solids content for TMP sludge to be truckable is 10%.

Belt filter press. A belt-filter press 1.6 ft wide was tested using unthickened primary sludge at 0.9% to 1.3% solids. The configuration found to be most applicable was three S-rolls followed by one nip roll. In the tests, a maximum of 36%-solids cake was obtained, with 7.4 lb/ton polymer and 95% capture. At maximum throughput, the belt press produced 30.6% solids with 9.3 lb/ton polymer and 90% capture.

To determine the effectiveness of the nip roll, the belt press was tested without it. Three test runs in this configuration produced 21% solids.

Thickened sludge was not available for these tests, so machine performance could not be determined. Basically, with thicker feed, the belt press can be expected to operate at higher solids throughput and produce slightly drier cake, with less polymer consumption.

Diaphragm press. The diaphragm press was tested with both thickened and unthickened sludge, and conditioned with either polymer or ferric chloride and lime. Generally, tests produced greater than 40%-solids cake, and no cake discharge or cloth blinding difficulties occurred during the tests. Tests with unthickened sludge basically confirmed that the yield (dry solids/filter area/hour) provided when feeding unthickened sludge was too low for economical operation. The maximum yield obtained by feeding 1.5% or less solids was 0.6 lb/ft²/hour, for which 43% solids was obtained.

More economical yields and similar solids contents were obtained by feeding thickened sludge. Feeding the discharge from a centrifuge at 3.4% to 4.0% solids, and without additional chemical dosage, provided yields of 0.7 to 1.0 lb/ft²/hour and sludge cakes of 41% to 46% solids. Using 9 lb/ton of additional polymer raised the average yield to 1.0 lb/ft²/hour and the solids content to 43% to 44%.

Conditioning with ferric chloride and lime, as opposed to additional polymer, caused similar improvements in yield with slightly higher cake solids.

Although feed consistency was important in the lower ranges, the tests show that there was little difference in yield when feed solids were between 4% and 7%. Also, thicker feed to the press did not necessarily provide a drier cake. From this it was concluded that thickening beyond 4% solids provides no particular advantage.

V-press. A production model V-press was tested on several types of dewatered sludge to determine its ability as a secondary dewatering device. In application, the V-press would serve to increase the dryness of dewatered sludge by several points and to back up the dewatering equipment when poor cake solids are being produced. Two conditions were tested:

- Wet sludge in the 10% to 12% solids range
- Moderate sludge in the 20% to 30% solids range.

In tests with wet sludge, the V-press was incapable of improving cake solids without the use of a sweetener. The fine solids extruded through the screen when feed was at 10% to 12% solids. Using bark fines as a sweetener, the sludge solids (corrected for initial bark moisture) could be raised as high as 32%. This required 50% bark by weight (dry basis).

In tests with moderately dewatered sludge, the V-press was able to improve solids content by three to nine percentage points. The ability of the press to improve dryness decreased with increasing feed cake dryness. In a test with 30%-solids cake from a belt press, the V-press produced a 33%-solids cake.

Conclusions from testing

Thickening. By inspection, it is apparent that the Hydrasieve method of thickening TMP sludge is most applicable for thickening to the 2.5%-solids range. The low capture rate caused some concern, but long-term operation by Bear Island has shown that an anticipated fines buildup has not occurred. In fact, polymer carryback to the primary clarifier with the filtrate is an effective means of polymer addition to the raw wastewater. The centrifuge proved an effective, though capital-intensive, method of thickening sludge to 4% to 7% solids. Capture rates were reasonable, as were polymer requirements.

Dewatering. Centrifuges, belt-filter presses, diaphragm presses, and V-presses are all feasible devices for dewatering TMP sludge. The 10%- to 12%-solids cake provided by centrifuges, although truckable, is so wet that most state

TABLE 4: **Equipment performance and operating parameters for TMP sludge**

	Feed solids	Cake solids	Polymer dose	Design feed rate
Hydrasieve	1.0%	2.5%	10-15 lb/ton[1]	340 gpm/unit
Centrifuge	1.0%	4.0%+	7 lb/ton	250 gpm/unit
Belt filter	2.5%	30.0%	None	90 gpm/unit
press	4.0%	30.0%	None	90 gpm/unit
Diaphragm press	4.0%	42.0%	None	9.9 lb/hr/ft²

1. Estimated from polymer purchase records
2. Feed from hydrasieve

regulatory agencies will not allow it to be landfilled. Vacuum filters are not feasible for use in dewatering TMP sludge. Therefore, the only good methods for dewatering TMP sludge are belt filters or diaphragm presses.

Economic analysis of methods

A V-press is fairly effective in improving poorly dewatered sludge to a higher solids content, using bark fines as a sweetener when necessary. A V-press is also capable of improving belt-press cake solids content by about three percentage points. The relative value of this is discussed in the following economic analysis.

An analysis was made to determine how to dispose of the sludge most economically. Three methods were considered: landfilling, burning, and land application.

In Bear Island's case, landfilling was very costly at $14/wet ton. Since landfill space is short in the area, other more economical disposal methods were pursued.

TMP sludge, dewatered enough to be spread on land in cake form, is also dry enough to burn. Therefore, only the injection method of land application using thickened (but not dewatered) sludge was considered. The analysis showed that adequate farm acreage close enough to the mill for economical operation was not available. Therefore, burning dewatered sludge was selected as the best alternative to landfilling.

Several promising combinations of thickening/dewatering were developed for consideration based on the technical conclusions from pilot tests. Hydrasieves and centrifuges were considered for thickening; and belt filter presses, diaphragm presses, and V-presses, for dewatering. Table 3 shows combinations selected for analysis.

Capital costs for a system with a capacity of 35 tpd (dry basis) of 1%-solids sludge were determined. In this analysis, performance conditions and loading rates for the equipment are those determined by tests and guaranteed by the manufacturer where possible (Table 4).

For each of the four combinations, capital costs were estimated for installation at Bear Island's facilities. Annual operating costs were developed, based on Bear Island's polymer, power, labor, and ash disposal costs. Since the solids content of the sludge that is to be burned is important, a determination of the annual fuel savings from burning sludge at various solids contents was developed. These costs and savings form the basis of the analysis, and are presented in Table 3.

The cost summary shows that combination No. 1, Hydrasieve thickening and belt filter press dewatering, is more economical than Nos. 2 and 4. No. 3, with a lower annual cost but higher installed cost than No. 1, is less economical than No. 1 by most analysis methods.

Combination	Initial cost	Annual cost
No. 1	$4,150,000	$337,000
No. 3	$5,800,000	$210,000
Difference	($1,650,000)	$127,000

Saving $127,000/year by investing $1,650,000 yields a first-year return of 8%, which was not attractive to Bear Island. Therefore, thickening by Hydrasieve and dewatering by belt press was selected by the mill.

The question of whether the additional three percentage points obtained using a V-press after the belt press is attractive can be answered by comparing combinations Nos. 1 and 2. The drier sludge from the V-press increased the sludge fuel credit by $33,000/year but power and maintenance costs for the V-press more than offset the increased credit.

A closer look at the cost data shows two significant sensitivities of this analysis. The greatest sensitivity is polymer cost. Using a centrifuge can cut polymer use by more than half. The polymer found to be most effective in all tests run on TMP sludge was a cationic polymer with medium charge density, costing $2.10/lb at test time. If polymer costs rose rapidly, centrifuge thickening would be more attractive. The other sensitivity is the sludge fuel credit. Rapidly rising fuel prices would make drier sludge more attractive. Conversely, inability to burn sludge would eliminate the credit and replace it with a landfilling or land spreading cost. Here, sludge density (weight dry solid/volume) would become important.

Operating experience

The selected sludge dewatering system has been operating since July 1981. Actual operations reveal a much higher solids loading than predicted in the of 100% TMP mill design. The solids were found to be very hard to dewater. As a result, additional solids handling equipment was needed. It was found that settling and underflow conditions were improved by maintaining a pH of 9.0 to 9.5 in the primary clarifier feed, adding residual polymer from the press effluent, and slowing down the clarifier rake speed by approximately 60%, to a tip speed of 10 fpm. The higher pH, polymer feed, and slower rake speed increased underflow solids from 0.8% to 1.2% up to 1.5% to 2.0%. Maintaining uniform underflow concentrations remains difficult due to varying conditions in the mill. Sludge storage tanks with mixing equipment dampen the effect of changes in sludge solids content as fed to the dewatering equipment. Increased retention in the primary clarifier has not helped to thicken the underflow.

Variation in sludge consistency requires continuous monitoring of the polymer dosage, which ranges from 10 to 20 lb/ton of dewatered sludge. Based on the tests run during the study period and information from the mill's operations, a Hydrasieve was chosen as the best means to thicken the sludge prior to dewatering on the belt filter presses. The polymer solution is added ahead of the Hydrasieve just prior to a static inline mixer. Flocculation occurs in the gently mixed headbox of the Hydrasieve.

Hydrasieve filtrate is returned to the primary clarifier carrying residual polymer to the clarifier, aiding in settling. Thickened sludge falls from the Hydrasieve directly to the press headbox and is dewatered to a cake of 25% to 33% solids at a rate of 20 to 26 tpd. The belt filter press has the capability of producing a drier filter cake by increasing nip pressure. But, fines in the sludge soon clog the belts, and belt-cleaning showers are no longer effective. This clogging effect limits overall cake dryness.

The cake sludge has a fuel value if cake solids are maintained above 25%. Presently a portion of the sludge cake is mixed with bark and blown to the hog fuel boiler as fuel. Additional equipment (presses, dryers) following existing belt filter presses is being considered to dry the cake to 35% to 45% solids, which will allow direct firing in the boiler and minimize cake handling needs. Experience shows that dewatering equipment for TMP sludge must be heavy-duty in design and highly corrosion resistant. Maintenance-free operation/reliability are as important, particularly when sludge burning is practiced. ☐

Dry forming establishing itself as commercial process—still problems

Advanced forming and bonding technology, absorbents, and the emerging market for adult incontinent products featured at fall Insight 82 conference

By WILLARD E. MIES, News & Business Editor

☐ Dry forming is establishing itself as a commercial process for making disposable absorbent products, but progress has been gradual and some problems remain.

The attractions of the technology—depositing fibers on a moving screen without the use of water—are still there. These include lower capital and energy costs than conventional wet forming, almost no pollution, flexibility to site plants near urban markets and, perhaps most important of all, the potential to make a variety of new products offering superior performance.

But holding back the process have been high raw material costs (due to the need for expensive binder to hold the fibers together), low machine speeds and efficiencies, a lack of available operating know-how and a complex tangle of litigation involving equipment suppliers and paper companies—although most of the latter has been now resolved.

The current state of dry forming technology was one subject discussed at the Insight 82 conferences sponsored by Marketing/Technology Service Inc. last October at the Marriott Hilton Head Resort on Hilton Head Island, S.C. The conferences—covering advanced forming/bonding, absorbent products, and adult incontinent products—attracted over 300 attendees from about 20 countries and featured a wide array of new product samples.

Current state of dry forming technology

The present stage of Kroyer dry forming was described by **Henning Skov Jensen**, sales manager, and **Sven G. Agren**, senior vice-president/consultant, for Moller & Jochumsen A/S (M&J Paper Div.), which has worldwide rights to market, license, and sell Kroyer plants. Seven companies in various parts of the world are currently operating commercial Kroyer plants, and about 20 more have installations under study, they said.

Kroyer dry forming plants can be supplied in a variety of configurations and sizes, ranging from "miniformers" of only 4 kg/hour (8.8 lb/hour) capacity up to commercial-scale installations ranging from 0.5 to 3 metric tons/hour, with a trimmed width up to 3.0 meters (118 in.). Equipment can be supplied to defibrate roll pulp, bale pulp, and secondary fibers.

The patented Kroyer integrated "sixer" forming head distributes fiber through a horizontal screen mounted parallel to the forming wire so that fibers fall an equal distance. This provides better control of the forming process and gives a machine-direction/cross-direction (MD/CD) profile of ±2%, according to Jensen.

There are various alternatives for bonding dry formed products. A typical machine layout might include pattern embossing/spraying of binder on one side of the web/flatbed through-drying/spraying of binder on the other side/flatbed through-drying and curing/product cooling and humidifying/and finally reeling. In another arrangement, pattern embossing might be followed by two-sided foam impregnation of binder and then drum-drying and curing in one operation.

Capital cost for a turnkey dry forming installation is only about 40% of that required for wet forming, Jensen said. Estimated capital cost of installing a 3 metric ton/hour, or 23,000-tpy, machine with a 3.0-m trim is about $11.5 million, of which about $8.2 million would be for machinery and equipment, he said. This works out to an investment per annual ton of only $500, vs $1300 for a 6 ton/hour, or 45,000-tpy, wet forming installation where the total investment would be at least $60 million.

Production costs compared to wet forming

Agren compared production costs per annual ton for three different size dry forming machines with those of the 6 ton/hour wet forming installation. A smaller 1 metric ton/hour machine would have higher production costs, while those of a 2 ton/hour machine would be about the same, and those for a large 3 ton/hour machine would be roughly 10% lower (see Table 2).

Depreciation and interest costs would be significantly lower because of the smaller capital investment involved, while energy costs would be about two thirds those of the wet forming unit. Power consumption was estimated at between 675 to 800 kwh/metric ton of trimmed products on the reel. Raw material costs for the dry forming installation, however, are higher because binder is about three times as expensive as pulp.

The product used in this estimate is a roll towel with a 10% latex content. Other dry formed products might require 20% or more binder, but their unique quality should command a higher price, Agren said. Dry forming capacity has mainly been applied to products where high softness, bulk, and absorption are important.

Lesson of a troublesome startup

Not all problems with dry forming have been worked out, however, according to **Dr. D. Milesi**, general manager of N.I.AV. SpA, who described the "lesson of a troublesome startup." N.I.AV. (Nuove Iniziative Avigliano) was created by a government financial agency to replace an idle corrugating medium mill in Avigliano, a small town in the Lucania region of southern Italy.

A 3-m-wide machine with a design capacity of more than 1 metric ton/hour was ordered and the plant began operation in September 1981. Startup of the plant proved to be more difficult than anticipated, with one factor being a worldwide lack of available operating know-how—"the knowledge of a whole sequence of operating tricks and of small gadgets which allow production with good efficiencies and which can only be acquired through long operating experience."

Such knowledge is now gradually being acquired, Milesi said, and N.I.AV. has been able to produce commercial quantities of material for kitchen roll towels (60 g/m^2, or 37 lb/3000 ft^2), industrial wipes (90 g/m^2, or 55 lb) and hospital bed sheets (60 to 70 g/m^2, or 31 to 37 lb). Production costs so far are ranging from 20% to 60% over those producing wet-laid tissue.

Nevertheless, Milesi believes that dry formed products will eventually capture a major share of the market

Update on commercial dry forming activities

U.S. companies that have recently been using dry forming to make absorbent disposable products have been Scott Paper Co., Johnson & Johnson Co., James River Corp., Fort Howard Paper Co., and Kimberly-Clark Corp. (see Table 1). The most successful commercial products appear to be consumer and industrial wipes, medical and health care products, and (to a lesser extent) kitchen roll towels.

K-C about two years ago began producing Softique facial tissue on an air forming line at its New Milford, Conn., mill, but now appears to be favoring a wet-formed version of this product, according to industry observers. The dry forming line is reportedly idle, but the company is said to be investigating other products for the installation. These would probably be bulkier than its facial tissue, which had a basis weight of only 30 g/m^2 (18 lb/3000 ft^2).

In a similar move several years ago, Scott Paper phased out an air-laid version of its Job Squad kitchen roll towel in favor of a wet-laid product, and is now concentrating on air-laid production of baby wipes and other products at its Dover, Del., plant, However, James River, which last year acquired the Dixie-Northern assets of American Can Co., is still producing Bolt kitchen towels, but is also expanding air forming at its Green Bay, Wis., mill into industrial wipes and medical products.

The extent of commitment required for commercializing the new technology was recently revealed by James River, which told security analysts that its air forming operation is now at the breakeven level after losses of $14 to $15 million a year ago, and as high as $24 million two years ago.

In Europe, there have been at least four new dry forming installations in the past couple of years. Vereinigte Papierwerke Schickedanz is test marketing a roll towel called Quilt in Fed. Rep. of Germany, produced on a Kroyer dry forming line in Nürnberg. N.I.AV. is air forming web for kitchen towels, industrial wipes and hospital bed sheets in southern Italy (see accompanying story). And Beghin-Say has installed an air-laid machine in France which may start up this year pending resolution of certain legal issues, according to industry observers.

Meanwhile, United Paper Mills of Finland and Dan-Webforming International have installed a joint-venture machine at the latter's facility in Aarhus, Denmark. The 1.8-m-wire-width drum-former machine has a design speed of 300 m/min and a capacity of 500 kg/hour (or about 12 metric tpd). Most startup problems have been overcome and the Uni-Web machine has been producing material for tablecloths, napkins, and roll towels. Plans are to double capacity of the line to 1000 kg/hour later this year (see article on p. 117). Dan-Web also claims to have an order for another new, more than 2.5-m-width dry forming machine to be installed in Europe this year.

Dry forming has already had a major commercial impact in the production of hardboard and medium-density fiberboard. Motala-Defibrator claims about 15 installations worldwide, including installations at Georgia-Pacific Corp., Holly Hill, S.C., and Louisiana-Pacific Corp., Eufala, Ala.

TABLE 1: **Commercial dry forming installations for absorbent products, based mainly on woodpulp**

Company	**Location**	**Products**
Scott Paper	Dover, Del.[1]	Baby Fresh wipes, industrial, wipes
Johnson & Johnson	Illinois/New Jersey[2]	Baby wipes, medical products*
James River (Dixie/Northern)	Green Bay, Wis.[3]	Bolt towels, industrial wipes, medical products
Fort Howard	Green Bay, Wis.[3]	Shur Wipe industrial wipes
Kimberly-Clark	New Milford, Conn.[3]	Softique facial tissue†
Honshu Paper	Fuji City, Japan[4]	Cigarette filter paper, towels, wipes
N.I.AV.	Avigliano, Italy[3]	Kitchen towels, industrial wipes, hospital bedsheets
Béghin-Say	France[3]	n.a.‡
Vereinigte Papierwerke Schickedanz	Nürnberg, W. Germany[3]	Quilt kitchen towels
United Paper Mills Dan-Webforming (Uni-Web)	Aarhus, Denmark[5]	Tablecloths, napkins, roll towels

Equipment/process: [1]Scott/Rando [2]Johnson & Johnson/Honshu [3]Kroyer [4]Honshu [5]Dan-Webforming (Scan-Web). Most original equipment supplied by machinery manufacturers has been modified in varying degree by absorbent product producers.

*No longer producing diaper facing. †Machine believed to be temporarily idle. ‡Awaiting startup.

Source: P&P estimates.

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for absorbent disposable products if manufacturing costs for the still-embryonic process can be lowered. This is because dry formed products, with their "limited reusability," fill a unique niche between more expensive durable wovens/nonwovens and cheaper nondurable wet formed tissue products, he said.

Dry forming production costs are not competitive because of high raw material costs and low machine speeds and efficiency, Milesi noted. Raw materials, which account for 60% to 75% of total manufacturing costs, are 20% to 40% higher than for wet forming, he said. Such costs could be reduced through optimization of binder use, development of a defibration system to use bale pulp rather than more expensive roll pulp, and the ability to recycle scrap containing binder back into the system.

Along with improved dryer fuel efficiency and lower electrical energy consumption, such improvements in the process would permit the manufacturer of superior quality products at a cost between 10% and 20% higher than the best quality wet-process products—resulting in prices that would be acceptable to a large segment of the market, Milesi believes. Manufacturers must develop more efficient second- and third-generation machines, he added, with speeds up to 500 m/min (1650 fpm)—a big jump over current levels.

James River experience with air-forming

A description of James River Corp.'s Airtex line and its capabilities was provided by **Michael P. Bouchette**, senior supervisor for air-forming product development.

Pulp in either roll or bale form is defibered by means of hammermilling, and then the fibers are transported to the forming section. Airflow and rotating paddles keep the fibers in a state of random agitation in the forming heads until gravity and applied vacuum cause them to deposit through a sifting screen onto the moving forming wire. Successive multiple forming heads are used to accomplish a gradual buildup of fiber, thereby increasing the web or fabric thickness. Once completely built up and formed, the web is transferred to the bonding section where it is spray-bonded with latex—first one side, and then the other—and then dried and cured.

Every step of the process lends itself to flexibility and the development of new products with unique attributes, according to Bouchette. These include use of varied pulp layers, different bonding latexes, various surface finishing treatments, different basis weights (from 30 lb to 65 lb/3000 ft^2), varying bulks and tensile strength. Webs can be produced with MD/CD tensile ratios as low as 1.25:1. Other options include color and varying degrees of compaction, calendering, and embossing.

Airtex nonwoven roll material has been used in such medical/health care products as surgeon's handtowels, incontinent pads, medical washcloths, and prep pads, and in such commercial and industrial products as baby wipes, premoistened towelettes, industrial shop wipes, and food service wipes.

A different area in which dry forming is already a firmly established commercial process is in the production of hardboard and medium-density fiberboard. An update on the Pendistor forming station was provided by **Peter H. Wiecke** of Sunds Defibrator, which has supplied lines to 15 customers since 1977.

Woodchips are fed through a pressurized refiner and the fiber is covered with resin (usually urea formaldehyde) prior to forming. The Pendistor forming head lays down a mat with a bulk density of 2 to 3 lb/ft^2 (32 to 48 kg/m^2) at a speed of 15 to 120 fpm (5 to 37 m/min). The fiber mats are then precompressed, trimmed in length and width, and inserted in a hot press where they are pressed into boards under pressure and heat.

TABLE 2: **Comparative costs for producing towels on Kroyer dry-forming units vs conventional wet forming machine**

	($/metric ton)			
Capacity	——— **Dry forming**		———	**Wet**
Ton/hour	1	2	3	6
Ton/year	7000	15,000	23,000	45,000
Cost				
Energy	65	55	50	85
Manpower/+admin.	180	85	55	45
Interest	55	30	25	65
Depreciation	110	60	50	130
Subtotal	410	230	180	325
Raw material	720	720	720	650
Total	**1130**	**950**	**900**	**975**

Source: Moller & Jochumsen (M&J Paper Div.) Insight 82 conference.

New method for tissue moisture profile control

Sam Palazzolo, senior product line engineer for Beloit Corp., discussed the application of induction heating to improve moisture profile correction on high speed, wide, single-felt tissue machines.

This can be done by installing an electromagnet near the outside surface of the dryer. When the magnet is energized, there is an electromagnetic field that intersects the portion of the dryer shell adjacent to the magnet. When the dryer surface is moving, the magnetic field produces currents in the dryer shell which in turn heat the shell surface.

A single row of d.c. inductors, installed along a line parallel to the roll axis and near the shell surface, is sufficient to adequately correct moisture profile on most tissue grades, he said. The maximum correction range depends on the characteristics of the magnets, the power level, the clerance gap, and the dryer speed.

The first such d.c. experimental moisture profile corrector was installed by Beloit on a machine in Holland on which moisture previously varied from a low of 5.9% to a maximum of 9.0%. After installation, the moisture profile was leveled to within ±0.1% at the same average moisture content of 8%. Actual average moisture levels at the reel were eventually raised from 4.5% to a level of 7%, resulting in an energy savings and permitting a 500 fpm increase in machine speed.

A second profiler was installed on a 5-m (16.4-ft) wide tissue machine in West Germany. Moisture profile variation was reduced from 5% to 2.2%, enabling an increase in machine speed from 4750 to 5400 fpm. The German mill also noted a reduction in energy consumption as moisture content was raised by 2% and both mills reported improved uniformity on the shell coating of their Yankee dryers.

Outlook: lightweight, thermally bonded nonwovens

In the U.S., the production of thermally bonded, lightweight, staple-based nonwoven fabrics is still small

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TABLE 3: **U.S. cover stock market, 1982**

(Millions of lb)	
By end-use	
Disposable baby diapers	135
Sanitary napkins, underpads, adult diapers, other	30
Total	**165**
By process	
Bonded staple	110
Spunbonded	53
Other	2
Total	**165**

Source: John R. Starr estimates.

and limited to specialty materials such as high-performance wipers, insulation, battery separators and a few other technical products, according to management consultant **John R. Starr** of Boston.

However, most major U.S. suppliers of lightweight staple fiber nonwovens are engaged in development programs to commercialize thermally bonded fabrics in large volume applications such as coverstock for disposable diapers, sanitary, and medical products. In Western Europe, thermally bonded lightweight staple nonwovens are already established in these large-volume coverstock markets, and consumption is growing.

The reasons for the interest in thermally bonded lightweight materials include a number of performance factors such as improved softness over resin-bonded materials, elimination of chemical binders, and the possibility of lower cost over resin-bonded fabrics in some cases, according to Starr.

The lightweight carded nonwoven business is in a mature stage of development, with growth rate for bonded carded staple nonwovens in the U.S. in lightweight disposable end uses expected to grow 5%/year through 1987 (from 200 million lb to 255 million lb). This is slightly below the 8%/year unit volume growth forecast for the entire U.S. lightweight disposable nonwoven sector (from 490 million lb to 730 million lb).

Nevertheless, the market potential for lightweight, thermally bonded carded fabrics is considerable. Although mature, the lightweight carded fabrics business still represents the single largest volume sector of the nonwovens fabrics industry in the U.S. and Western Europe. Thermally bonded fabrics can probably replace most conventional resin-bonded materials and capture a major portion of the coverstock market in both regions.

Although there are other end-use markets, coverstock will be by far the largest volume use for lightweight, thermally bonded fabrics. Total U.S. coverstock shipments in 1982 are estimated at 165 million lb, of which bonded staple represents 110 million lb, or 65% (Table 3). Baby diaper coverstock represents 135 million lb, or 82% of all coverstock consumption. Western European coverstock output in 1982 is estimated at 130 million lb.

Spunbonded to increase coverstock market share

Spunbonded is expected to continue to increase its share of both the U.S. and European coverstock markets during the next five years, while bonded staple fabrics lose share but still grow in total pounds. Manufacturing costs by 1987 for lightweight spunbonded polypropylene are forecast to be 15% to 20% lower than for carded, thermally bonded polypropylene staple fabric.

However, lightweight, thermally bonded staple fabrics are being produced in pilot quantities that are superior in softness to resin bonded and spunbonded fabrics now commercially available in the U.S. Thus, they will probably find initial use in premium priced disposable baby diapers, sanitary napkins, and similar products.

Richard G. Mansfield, president of R.G. Mansfield & Associates, agreed that the use of thermal bonding is growing as a wider range of thermoplastic and specialized bicomponent fibers has become available. Also helping is development of new thermal bonding equipment, such as calenders and heated air systems, and more precise solid-state electronic controls for temperature.

Ultrasonic bonding is a newer form of thermal bonding that is now being practiced commercially and has good potential for future growth. Kimberly-Clark Corp. has several patents in this area, one of which discloses use of sonic bonding in combination with stretching to produce an apertured structure. Several firms are now reported to be working on laser bonding systems for nonwovens, Mansfield said.

Meanwhile, the growing interest in thermal bonding is causing resin binder producers to try to upgrade their products. Much of this effort on resin binders is directed toward elimination of formaldehyde and the reduction of temperatures required for curing.

Major growth seen for adult diapers

A major new market for fluff pulp, superabsorbents, and lightweight nonwoven coverstock is expected to be in adult diapers. About 3% of males and 8% of women in the U.S. suffer from urinary incontinence, according to two recent studies cited **Beth Gove**, a nurse consultant for M/TS—or at least 8 million people, especially the elderly, according to **Charles A. Stocking**, executive vice-president of Principle Business Enterprises Inc., a supplier of adult diapers.

However, most adult diapers currently on the market are poorly designed and are little more than scaled-up baby diapers, according to **James P. Hanson**, director of M/TS, who recently completed a major testing evaluation of products currently available. High costs to the consumer are another problem, but these should come down as the market expands and competition among producers increases. ☐

Proceedings of papers presented at Insight 82 are available from Marketing/Technology Service Inc., 3125 W. Main St., Kalamazoo, Mich. 49007. The Insight 83 advanced forming/bonding; absorbent products; and adult incontinent products conferences will be held Nov. 13-19 at La Mansion del Rio Hotel, San Antonio, Texas.

M/TS is also holding a series of Focus 83 and Impact 83 conferences this spring at Epcot Center, Lake Buena Vista, Fla., covering twin-wire and new formers (May 8-10); composite and laminated structures (May 8-10); wet end developments (May 11-12); durable nonwovens and specialty markets (May 11-12); and computer opportunities for the nonwoven and paper industries (May 13).

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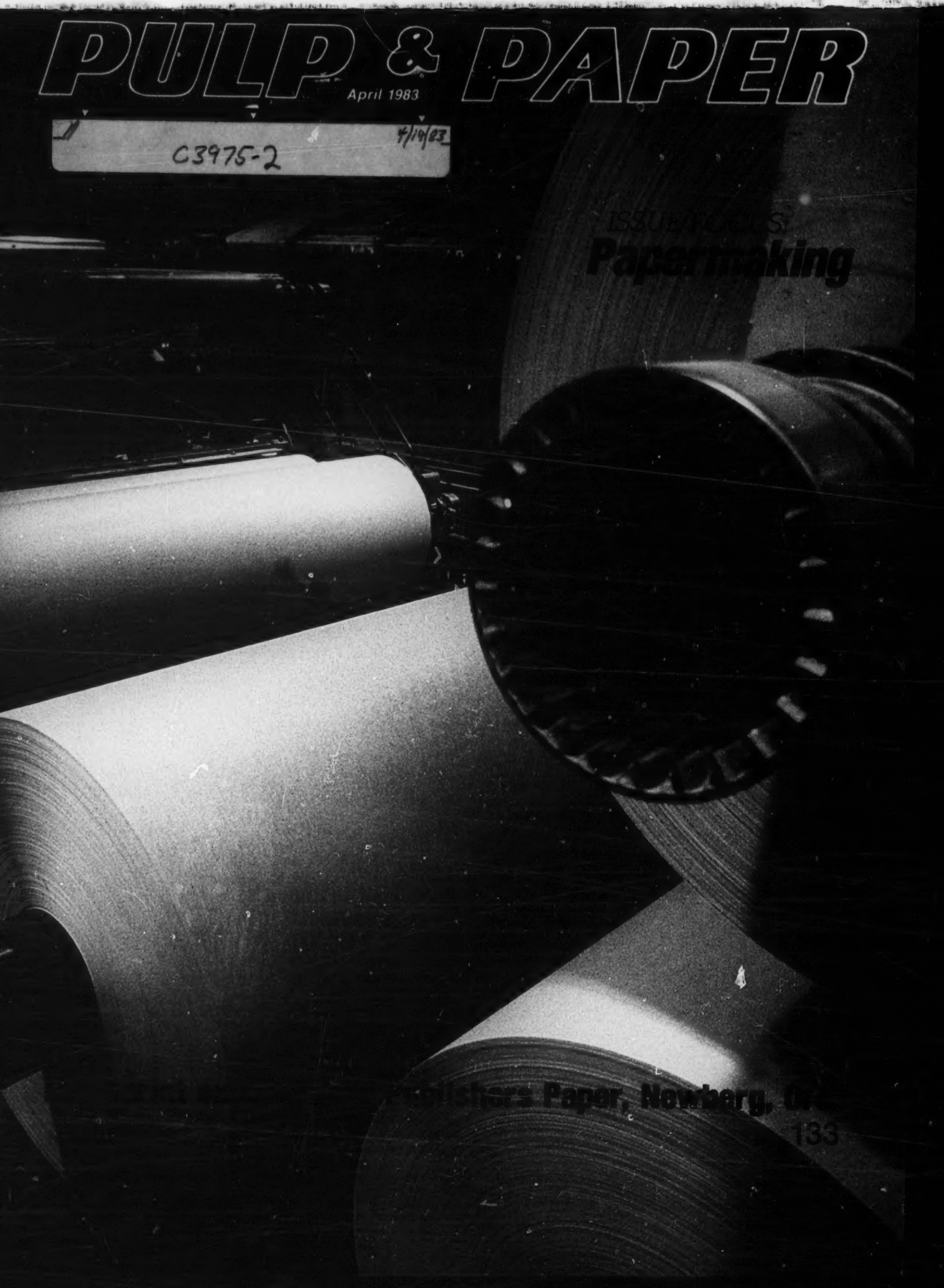

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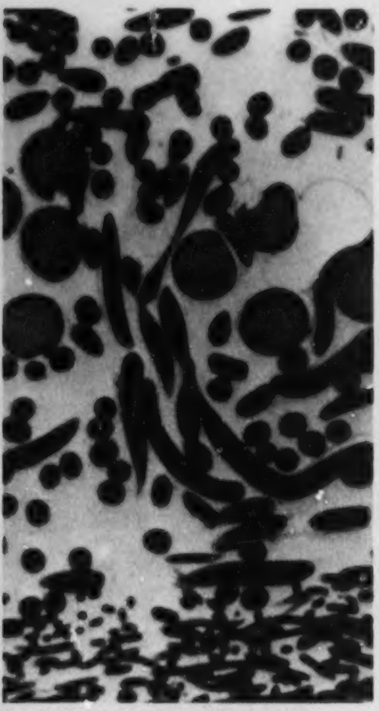

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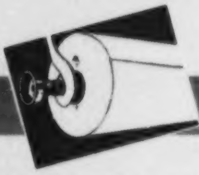

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***COVER:** View of the dry end of Publishers Paper's new 210,000-tpy Voith Duoformer C twin-wire newsprint machine, heart of the Newberg, Ore., expansion. (Photo courtesy of Times Mirror.)*

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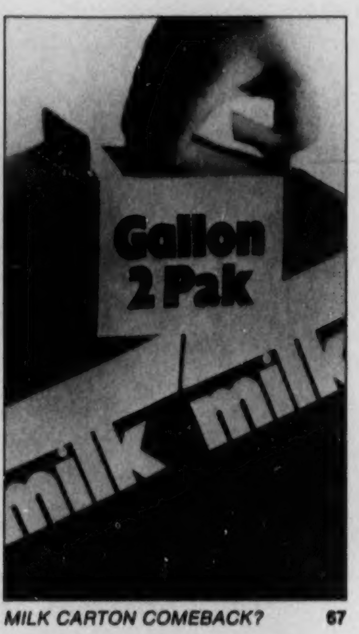

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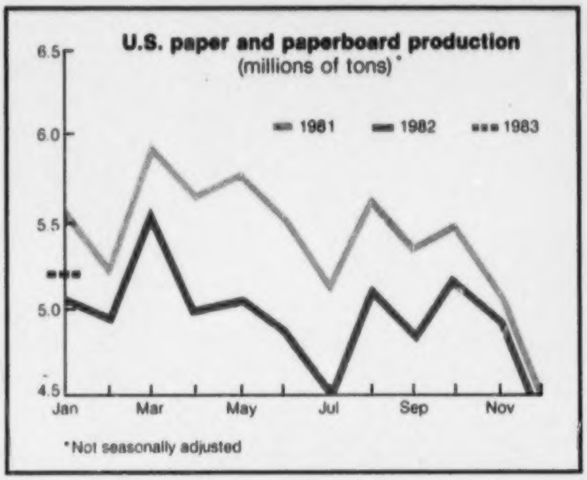
MONTH IN STATISTICS

U.S. paper and paperboard production got off to a brisk start in January, totaling 5.2 million short tons, up 5.3% over the year-ago level, according to the American Paper Institute. The production trend, as measured by the two-month moving average of the seasonally adjusted data, was 61.0 million tpy, about 2% below the record-high average rate attained in 1981.

Among major grades, the strongest gains in paper production were in the printing and tissue sectors. Preliminary data also indicate some recovery in the packaging grades, but lackluster performance for bleached bristols. Paperboard production showed a stronger pattern than paper in January, rising 7.4% from its January 1982 level. Both solid woodpulp and recycled grades shared in this gain, rising 7.3% and 7.7%, respectively, over year-earlier levels. Containerboard production for domestic use rose 7.5% over year ago.

Total Canadian newsprint shipments in January came to 604,000 metric tons, down 9.9% from January 1982, according to the Canadian Pulp & Paper Assn. Newsprint mill operating rates rose to 81% from 71% in December, but were well below the 95% rate of a year earlier.


U.S. paper and paperboard production
(millions of tons)*

*Not seasonally adjusted

		Latest month (000 short tons)	% change from year ago	Annualized year-to-date (000 short tons)	% change from year ago
PAPER & PAPERBOARD PRODUCTION[1]					
Newsprint	January	444	−3.1	5,332	−2.9
Uncoated groundwood (s)	January	114	1.8	1,364	1.9
Coated paper (s)	January	427	5.7	5,128	5.7
Uncoated free sheet (s)	January	686	5.5	8,226	5.5
Unbleached kraft packaging and industrial (s)	January	325	3.8	3,900	3.7
Tissue	January	390	8.9	4,680	9.0
Total paper	**January**	**2,623**	**3.3**	**31,475**	**3.4**
Kraft linerboard, unbleached	January	1,202	12.0	14,429	12.0
Semichemical medium	January	383	2.1	4,593	2.2
Bleached paperboard	January	322	4.5	3,869	4.5
Recycled paperboard	January	587	7.7	7,043	7.7
Total paperboard	**January**	**2,575**	**7.4**	**30,905**	**7.4**
Total paper and paperboard*	**January**	**5,198**	**5.3**	**62,380**	**5.3**
PULP, WASTEPAPER & FIBER[2]					
Total woodpulp production	December	3,548	−1.9	49,367	−5.1
Market pulp production	December	378	11.6	5,668	−8.7
Wastepaper consumption at paper/board mills	December	1,025	−7.5	13,525	−2.5
Pulpwood consumption (cords)	January	n.a.		n.a.	
CONVERTED PRODUCTS STATISTICS[3]					
Corrugated box shipments (billion ft²)	January	19.980	5.7	19.980†	5.7
Containerboard inventories at box plants	Jan. 1	2,590	−1.4		
INTERNATIONAL TRADE[2]					
U.S. paper imports (including products)	December	605	−6.1	8,022	−3.8
Imports of Canadian newsprint	December	498	−10.6	6,485†	−6.5
U.S. paper exports (including products)	December	344	1.8	4,246	−8.5
Exports of unbleached kraft linerboard	January	180	36.4	2,165	36.9
Exports of woodpulp	December	285	−9.5	3,394	−7.7
CANADIAN STATISTICS[4] (reported in metric tons)					
Total newsprint shipments	January	604	−9.9	604†	−9.9
Operating rates	January	81%	95%	81%	95%
Inventories held by U.S. consumers	Jan. 31	1,247	−20.1		
Woodpulp shipments (export only)	January	433	−4.0	433†	−4.0
Operating rates	January	73%	82%	73%	82%

1. American Paper Institute. 2. API, Bureau of Census, American Pulpwood Assn. 3. Fiber Box Assn., Paperboard Packaging Council. 4. Canadian Pulp & Paper Assn.
*Includes construction and wet machine grades. †Not annualized. ‡Not directly comparable to year ago because of coding change. (s) = shipments.

(Continued from page 31)

Technology Inc. is engineering the project. Earlier, the company indicated it was considering the project due to high energy costs and solid waste disposal problems (P&P, Mar., p. 37).

The boiler is slated to come online late in 1985 and be fully operational by early 1986. Construction is expected to begin this fall, by which time all necessary environmental permits should have been obtained, the company noted.

- **Procter & Gamble Paper Products Co.** plans to spend more than $10 million to install a new energy system at its Green Bay, Wis., tissue mill to burn bark and other solid waste material. When the new system is completed in mid-1983, most incoming pulpwood to the mill will be debarked. The bark will be combined with other solid waste and burned in a fluidized-bed combustion unit to generate heated air for throughdrying.

The process is expected to burn about 250 tpd of bark and 20 tpd of other waste, saving 560 million ft^3/year of gas.

ENVIRONMENT

St. Regis sued over particulates

St. Regis Paper Co. was sued recently by Environmental Protection Agency for $100,000 for alleged violation of federal, state, and regional air quality rules at its 1000-tpd Tacoma, Wash., market kraft pulp mill. The suit, filed in U.S. District Court in Tacoma, claims the mill exceeded particulate standards on four occasions, and asks the court to order the mill to meet appropriate national ambient air quality standards.

EPA claims the Puget Sound Air Pollution Control District detected 18 violations at the mill in 1980 and 1981, and EPA gave the company a notice of violation in July 1981, giving the mill 30 days to meet particulate standards. The current suit claims that on four occasions after that 30-day period—on Nov. 1, 1981, and on May 24, Aug. 25 and Oct. 14, 1982—further violations occurred. A $25,000 fine can be levied for each violation of those standards.

St. Regis would not comment on the suit, although the mill manager said the company has spent $425,000 on equipment to satisfy EPA demands.

PRODUCTION

U.S. paper output off 4.3% in 1982

U.S. paper and paperboard production totaled 59.4 million tons in 1982, 4.3% below the revised 1981 total of 62.1 million tons, according to American Paper Institute statistics. This reflected the overall trend of the economy in which real GNP fell 1.8% and manufacturing production declined 8.6%.

"The trend of paper and paperboard production through 1982 could be likened to a suspension bridge: rising in the first quarter; falling in the second; rising again in the third; and tilting downward again towards the end of the fourth quarter."

Reflecting the large number of mill and machine shutdowns at yearend, the two-month seasonally adjusted moving average for paper/paperboard production dropped below the 60-million-tpy rate in December for the first time since August, API noted. Before the December drop to 59.3 million tpy, production was running about 60.6 million tpy last fall.

U.S. paper and paperboard production

	Production	New Supply†	Ratio new supply/ $ billion real GNP
1982	59,444	62,914	42,640
4th*	59,589	63,599	43,210
3rd*	59,742	62,515	42,210
2nd*	57,852	61,248	41,430
1st*	60,874	64,572	43,910
1981	62,126	65,506	43,600
4th*	59,955	64,300	43,150
3rd*	63,184	65,982	43,690
2nd*	62,429	65,458	43,570
1st*	63,146	66,498	44,100
1980	61,147	64,303	43,620
1979	61,271	66,399	44,880
1978	58,744	64,224	44,640
1977	56,823	60,946	44,500
1976	55,151	58,805	45,300

*Quarterly production, new supply data at seasonally adjusted annual rate.
†Production + imports − exports (export/import data for 1982 estimated).
Source: American Paper Institute.

Among major grades, printing/writing paper production held up fairly well in 1982, with uncoated free-sheet shipments of 7.8 million tons down only 0.8%, and coated paper shipments up 2.9% to 5.0 million tons. Newsprint fell 3.6% to 5.0 million tons, while tissue was off 2.9% at 4.4 million tons.

Packaging grades were hard hit by the sharp downturn in U.S. manufacturing activity. Unbleached kraft linerboard production declined 6.5% to 13.6 million tons, solid bleached board production declined 5.8% to 3.7 million tons, and recycled paperboard dropped 5.8% to 6.6 million tons. Unbleached kraft packaging paper shipments dropped 5.2% to 3.5 million tons.

U.S. imports of paper/paperboard in 1982 (mainly newsprint) were estimated at 7.6 million tons, down 4.1% from 1981 levels, while exports of 4.1 million tons were down 9.1%.

New supply (apparent consumption) of U.S. paper and board for 1982 totaled 62.9 million tons, down 3.9% from 1981. Ratio of new supply per billion dollars of real GNP declined to 42,640 tons in 1982 from 43,600 tons in 1981 and a similar level in 1980, indicating some slight further slippage between paper and the general level of business activity.

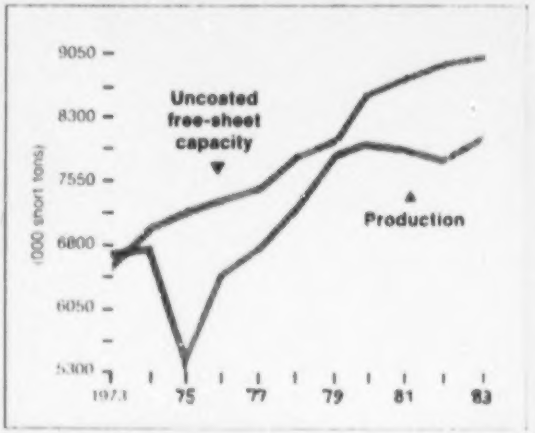
Corrected reprints of bleaching technology review available

The article "Bleaching technology review: recent developments, future trends," which appeared in the October issue of PULP & PAPER (page 61), contained several textual and graphic errors. This five-page article by Martin MacLeod has been corrected and is now available in reprint form. Interested readers should write: Dana M. Baker, PULP & PAPER, 500 Howard St., San Francisco, Calif. 94105.

Uncoated printing/writing papers: Turnaround in progress and record performance possible

Statistics	**1981**	**1982**	**1983e**
Production, 000 tons'	7898	7837	8111
Capacity, 000 tons	8828	8937	9049
Utilization rate, %	89.5	87.7	89.6
Imports, 000 tons	127	169	150
Exports, 000 tons	117	72	80
Apparent U.S. consumption			
000 tons	7908	7934	8181
lb/capita	69.2	68.8	70.2
000 tons/$ billion real GNP	5.26	5.38	5.36

'American Paper Institute data for shipments
e=Pulp & Paper estimate



Estimated capacities of major U.S. companies are:

	Annual capacity (000 tons)	**Capacity share** (%)
1. Champion International	795	8.8
2. Boise Cascade Corp.	791	8.7
3. Great Northern Nekoosa	700	7.7
4. International Paper Co.	675	7.5
5. Hammermill Paper Co.	633	7.0
6. Union Camp Corp.	490	5.4
7. Georgia-Pacific	464	5.1
8. Weyerhaeuser Co.	450	5.0
9. Mead Corp.	430	4.8
10. P.H Glatfelter Co.	430	4.8
11. Simpson Paper Co.	355	3.9
12. Finch, Pruyn	200	2.2
13. Pentair Inc.	187	2.1
14. Westvaco Corp.	180	2.0
15. Scott Paper Co.	160	1.8
16. Fraser Paper Ltd.	150	1.7

U.S. annual capacity (1983): **9.049 million tons**
Capacity share of top five companies: 39.5%
Capacity share of top ten companies: 64.7%

Grade structure: Papers included in this grade are uncoated and are made with 10% or less mechanical pulp in the furnish. End-uses fall into such general areas as book and other printing paper (including offset, cover, and text); office papers (including forms, copy, tablet, and envelope); and miscellaneous papers (such as technical, papeterie and colored school). Not included are uncoated groundwood, cotton fiber, bristols and thin papers.

Production/capacity: A two-year slump followed 1980's record, and new areas of weakness appeared in 1982. But during the second half, end-uses such as copy paper, forms bond and roll offset printing papers began to recover, with copy paper shipments actually rising 2% in 1982. Shipments to the ailing book industry fell by almost 10%, however.

As result of a 1.2% increase in capacity, operating rates averaged just 88% for the year and only 84% in the third quarter. A further 1.3% rise in capacity is expected by American Paper Institute for 1983—far short of the 3.5%/year pace of the 1970s.

Outlook: Merchant and consumer inventories were at bare bones levels in 1982 and mill order backlogs fell to a week or less in some cases. Going into early 1983, however, consumption began to recover and order backlogs to lengthen. With economic activity turning up, outlook for office grades is for an improvement over 1982 levels ranging from 1% to 6%. The book industry expects little growth, however, dampening prospects somewhat for publishing grades.

Pricing: Prices fell sharply for most grades until late 1982, with customers accepting substitute grades to gain price advantage and some mills offering discounts with apparently little regard for costs, simply to win business. As a result, peak pricing achieved in mid-1981 may not be seen again until late 1983 or early 1984, although competitive discounting was on the wane in early 1983.

Two important grades have been chosen as representative of pricing trends. Prices shown are year-end, $/short ton, list quotes. (The 1982 numbers shown in parentheses are estimated range of transaction quotes. List prices before 1982 considered reliable.)

Book paper, No. 3 offset, 45-lb, sheets—1972, $460; 1974, $535; 1976, $506; 1978, $645; 1980, $813; 1981, $878; 1982, $878 ($580-$600). Forms bond, 15-lb, rolls—1972 not available; 1974, $470; 1976, $519-$520; 1978, $538-$550; 1980, $697; 1981, $753; 1982, $753 ($680-$700).

Markets: Estimated shipments by end-uses are: bond, mimeograph, duplicating, xerographic—24%; forms bond—21%; offset printing—26%; envelope—11%; tablet—5%; other—13%.

Peroxide substitution can reduce bleaching chemical, energy costs

Partial replacement of chlorine dioxide with peroxide in second extraction stage of bleaching sequences possible without decreased pulp quality

By MICHAEL G. DODSON

☐ Recently the pulp and paper industry has experienced an unprecedented resurgence of interest in hydrogen peroxide bleaching of kraft pulp. This technology usually involves the partial replacement of chlorine dioxide by hydrogen peroxide. Previous papers (ref. 1 and 2) have described the addition of alkaline peroxide to the second extraction stage (E_2) to reduce ClO_2 consumption in the $D_1$and D_2 stages of $CE_1HD_1E_2D_2$ and $CE_1D_1E_2D_2$ sequences. Evaluations in the laboratory and in the mill have shown that at least 25% of the applied ClO_2 in a bleaching sequence can be replaced by peroxide in a 2:1 ratio (by weight). One overriding factor, economics, has spurred ten kraft mills to evaluate peroxide in the second extraction stage during the last three years.

H_2O_2 substitution provides the following benefits:

- Chemical cost savings
- Energy cost savings
- Possible capital cost savings
- Improved bleach plant efficiency.

The manufacture of sodium chlorate is very energy-intensive. Approximately 50% of the total manufacturing costs and 75% of the variable costs are directly related to energy. Figure 1 shows the relationship of sodium chlorate list prices to energy costs. Both electrical power and chlorate prices have increased dramatically in the past decade. On the other hand, hydrogen peroxide manufacture by the auto-oxidation of anthraquinone is less energy-dependent, with only one-quarter of the total costs tied to energy.

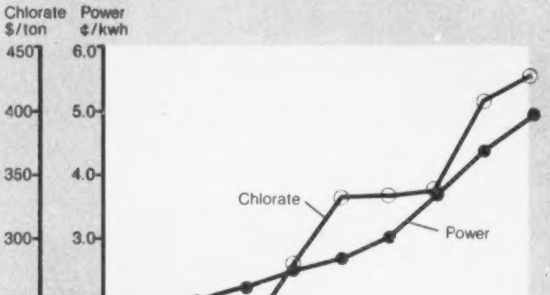
From 1970 to 1982, the average yearly price increase for sodium chlorate was 9.6%, while the average inflation rate ran 7.8%. In comparison, price increases for hydrogen peroxide averaged only 3.1% in the same period. The net result has been a favorable economic picture for peroxide vs chlorine dioxide. Figure 2 qualifies the change in

TABLE 1: **Mill A—kraft softwood*: K number = 23**

	Standard bleach sequence CE/HDED	Hydrogen peroxide bleach sequence CE/HDPD	Difference
ClO_2 applied (lb/a.d. ton)	24.6	18.4	6.2
H_2O_2 applied (lb/a.d. ton)	—	3.0	3.0
Brightness (Elrepho)	89.8	91.4	1.6
Dirt	2.1	2.8	0.7
CEK number (permanganate number)	4.1	3.9	0.2
Tower temperatures			
D_1 (°F)	140	130	10
E_2 (°F)	160	155	5
D_2 (°F)	160	150	10

*80% softwood and 20% hardwood

FIGURE 1: **Chlorate price dependency on power cost**



Source: *Monthly Energy Review;* Sept. 1982, p. 92

Mr. Dodson is industrial manager, Interox America, Houston, Texas economics of this technology based on list pricing of chlorate (converted to ClO_2 costs) and peroxide, with a replacement ratio of 2:1.

Benefits of substitution

The two major benefits of peroxide substitution are an overall reduction in chemical and energy costs. Although all mills with CEDED or CEHDED sequences have the potential for obtaining these benefits, each mill should evaluate its own specific case based on the following key factors:

- Cost of ClO_2 generation
- ClO_2 production capacity vs bleached pulp production capacity
- Mill incremental steam costs
- Pulp quality
- Capital costs for implementation.

Production costs for chlorine dioxide vary widely throughout the paper industry, typically \$0.40 to \$0.60/lb, due to different methods for ClO_2 production (i.e., R-2, Mathieson, Solvay, R-3, SVP), variations in ClO_2 generator efficiency, and mill accounting practices. As a general rule, only the variable costs should be considered when making a preliminary economic evaluation; since fixed costs—such as labor, maintenance, and depreciation—will not change, they don't have to be considered.

Chemical and power costs represent the two key variable charges. Additional variable charges include royalty fees and catalyst use. Appendix A, a typical cost-analysis sheet, can help in calculating variable and fixed costs for chlorine dioxide generation.

Chlorine dioxide generators vary in efficiency depending on the type of generator and on its actual operation. Generators operated at a higher production level than design capacity and without proper routine maintenance may not perform efficiently. Theoretically, for an R-3 or SVP generator, 1.65 lb of sodium chlorate are required to produce a pound of ClO_2. However, in general, when a generator is performing well, 1.80 lb of chlorate is consumed per lb of ClO_2 produced. It is important to qualify the generator's efficiency while operating under typical production conditions. Once the efficiency is determined by mass balance, it should be correlated with accounting receipts for chlorate purchases.

Chlorate and either spent acid or saltcake are byproducts of the more popular ClO_2 generators. Realistic credits for the value of these byproducts to the mill can be subtracted from the cost of producing ClO_2. Credits should not, therefore, be taken for excess byproducts that end up in the sewer, such as saltcake, spent acid, or hypo. In fact, reducing chlorine dioxide consumption could improve the overall mill chemical balance. The amount of these byproducts can be calculated theoretically, but this should be confirmed by actual measurements for construction of a chemical mass balance.

At some mills, pulp production rates require ClO_2 in quantities which match or exceed rated generating capacity. By using hydrogen peroxide in these cases, the mill can bleach incremental tonnage without high capital expenditures (\$1- to \$2-million) for a new ClO_2 generator. This practice would not only improve profits but also increase the ClO_2 efficiency of the generator by allowing it to run closer to rated capacity.

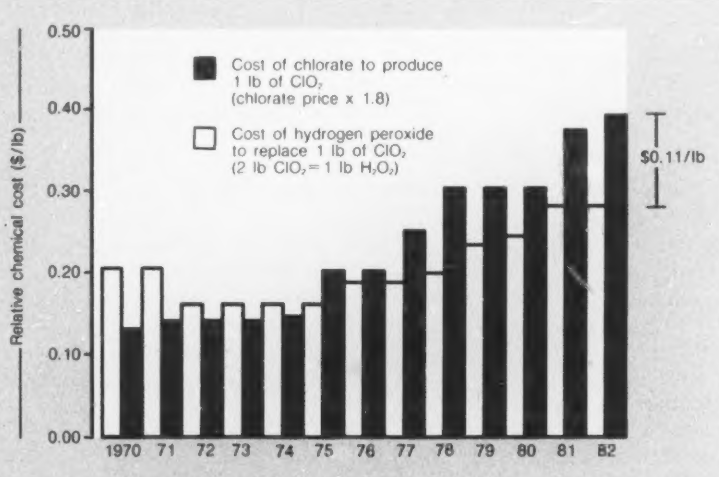
As a result of peroxide introduction into the second extraction stage, bleaching activity is distributed more equitably across the final three stages. Reducing ClO_2 in $D_1$and D_2 allows significantly lower tower temperatures which allows control of the residuals in these stages.

Potential energy savings from peroxide substitution can equal the chemical savings, depending on mill incremental steam costs. The highest incremental steam cost, rather than mill average steam cost, should be used when this savings is calculated because demand for supplemental fossil fuel in a power boiler would be reduced, as opposed to reducing the load of a recovery or hogged fuel boiler.

Effect on pulp quality

With any process change in the bleach plant, the effect on pulp quality must be carefully considered. The parameters possibly affected by peroxide substitution include brightness, stability, viscosity (as an indication of

FIGURE 2: **Chemical cost**



Source: *Chemical Marketing Report*, Jan. 1979-Sept. 1982
Chemical Economics Handbook, Mar. 1981

TABLE 2: **Mill A economics**

Total savings = \$453,000/yr
Chemical savings = \$191,000/yr
Steam savings = \$262,000/yr

Assume:
ClO_2 cost is \$0.42/lb
H_2O_2 cost is \$0.395/lb (70% H_2O_2)
Steam cost is \$3.25/1000 lb steam
Production is 600 a.d. tpd

pulp strength), and dirt count. Laboratory bleaching studies can define the effects of the first three variables. Unfortunately, statistically reliable data on dirt level cannot be generated in the laboratory.

The efficiency of chlorine dioxide for shive bleaching might imply an increase in dirt level with a reduction in chlorine dioxide. A difficult question that must be answered in each mill location is: How much ClO_2 is necessary for achieving pulp cleanliness standards? Each mill should consider the four parameters which heavily affect dirt level: chip quality, cooking, screening, and chlorination. Previous experiences indicate that, when reasonable process performance standards are met for these four parameters, substitution will not detrimentally affect dirt level.

If quality or control problems exist in any of these areas, then bleach plant chemical costs will be high, and bleached pulp quality will be erratic. In addition, large variations in pulp quality make statistical analysis of hydrogen peroxide trial results difficult. In other words, from the standpoint of both mill and supplier, major performance problems in the above four key areas should be resolved prior to any attempt to optimize bleach plant chemical costs.

When there are no major concerns over the dirt-level factors, it is much easier to implement hydrogen peroxide addition to the second alkaline-extraction stage. The required storage and handling system includes an aluminum bulk storage tank for 50% peroxide, a peroxide metering pump and flowmeter, piping from the storage tank to the D_1washer/repulper, and a dilution method for reducing the peroxide strength to assure uniform mixing with the pulp.

Capital expense for the system should not exceed $100,000, provided an appropriate site for the storage tank is available. Additional requirements for handling peroxide stabilizers are not normally needed in this application. Also, the acidic chlorination and initial chlorine dioxide stages remove enough of the heavy metals normally present in the pulp to avoid wasteful decomposition of the peroxide. When unusually high levels of heavy metals, such as iron or manganese, are present in the mill process water, then stabilizers should be considered.

H_2O_2 case histories

After considering all the key factors, three Southern kraft mills decided to investigate the use of hydrogen peroxide. Results obtained from trials at these three mills are described below.

Mill A produced 600 tpd of 89° brightness softwood and hardwood pulp. Hardwood and softwood chips were pulped separately in batch digesters and blended prior to brownstock washing. The mill's interest in peroxide arose due to an expansion which required the bleach plant to produce 750 tpd. Since the mill's R-2 generator was producing above capacity, hydrogen peroxide was a reasonable alternative to rehabilitating an old chlorine dioxide generator.

Table 1 represents one month of data prior to the trial and one month of data using hydrogen peroxide in the second extraction stage. The chlorine dioxide application level was reduced from 24.1 lb/ton to 18.4 lb/ton while maintaining (comparable) dirt level and *improving* the final pulp brightness. Table 2 shows potential economic results based on the technical data. The costs of steam, ClO_2, and H_2O_2 do not represent this individual mill's specific costs but instead present a conservative estimate to establish the magnitude of savings when using peroxide in this application. In fact, actual mill savings exceeded the amounts shown in all examples (Tables 2, 5, 6, and 8) in this article.

TABLE 3: **Mill B—kraft hardwood: K number = 12**

	Standard bleach sequence CEDED	Hydrogen peroxide bleach sequence CEDPD	Difference
ClO_2 applied (lb/a.d. ton)	20.8	15.0	5.8
H_2O_2 applied (lb/a.d. ton)	—	2.5	2.5
Brightness (Elrepho)	91.1	91.3	0.2
Dirt	4.7	3.0	1.7
CEK number (permanganate number)	1.2	1.1	0.1
Tower temperatures			
D_1 (°F)	206	171	35
E_2 (°F)	171	165	6
D_2 (°F)	163	160	3
Viscosity-D_2 (cps)	18.2	19.0	0.8

Mill B is a large market pulp mill with two lines—one hardwood and one softwood. Hardwood is produced with a Kamyr continuous digester, while softwood is produced in an Esco digester. Mill production capabilities were limited by the capacities of two ClO_2 generators (R-2, SVP). The installation of a peroxide system for each bleach plant removed the chlorine dioxide production bottleneck. The mill can now routinely boil out the SVP generator and operates the R-2 generator only 25% of the time.

Tables 3 and 4 show that chlorine dioxide consumption dropped significantly while pulp quality was maintained. It should be noted that tower temperatures were reduced notably without an increase in dirt counts for the pulp. Table 4 compares a month's data prior to peroxide use and a month's data after eight months of peroxide use. This data show that the anticipated results occur not only under controlled trial conditions but also under routine operating conditions.

Mill C produces 700 tpd of bleached softwood for bleached foodboard and for market sales. In this application, 3.5 lb/ton of peroxide replaced 6.4 lb/ton of ClO_2. Although the replacement ratio was less than 2:1, the trial proved that tower temperatures can be brought below any previously expected level under specific mill situations. The $D_1$and D_2 tower temperatures were reduced significantly while brightness and dirt count were slightly improved, as Table 7 shows.

Increased interest in use of hydrogen peroxide in kraft pulp bleaching is primarily due to the overall improvement in bleaching costs. Mills are evaluating the key factors concerning peroxide use and consider its advantages well worth implementing. Although hydrogen peroxide is unique as a nonpolluting selective bleaching chemical, its future will be determined to a large extent by utilizing these properties in an *economical* framework. ☐

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1. R.R. Kindron, *Tappi*, 62 (9): 67 (1979).
2. H. Loutfi, *Pulp & Paper Canada*, 81 (12): T374 (1980).

TABLE 4: **Mill B—kraft softwood**

	Standard bleach sequence CEDED	**Hydrogen peroxide bleach sequence CEDPD**	**Difference**
ClO_2 applied (lb/a.d. ton)	30.9	21.1	9.8
H_2O_2 applied (lb/a.d. ton)	—	5.0	(5.0)
Brightness (Elrepho)	90.6	90.4	0.2
Dirt	16.9	16.3	0.6
Tower temperatures			
D_1 (°F)	200	165	35
E_2 (°F)	172	159	13
D_2 (°F)	196	166	30
Viscosity-D_2 (cps)	11.2	14.4	(3.2)

TABLE 7: **Mill C—kraft softwood: K number=21**

	Standard bleach sequence CE/HDED	**Hydrogen peroxide bleach sequence CE/HDPD**	**Difference**
ClO_2 applied (lb/a.d. ton)	30.9	24.5	6.4
H_2O_2 applied (lb/a.d. ton)	—	3.5	3.5
Brightness (Elrepho)	88.0	88.9	0.9
Dirt	0.5	0.2	0.3
CEK number (permanganate number)	4.6	5.0	0.4
Tower temperatures			
D_1 (°F)	156	121	35
E_2 (°F)	154	139	15
D_2 (°F)	171	147	24
Viscosity-D_2 (cps)	14.9	15.0	(0.1)

APPENDIX A: **Pulp and paper production cost estimate: 1985**

Date: ____________ **Product: Chlorine dioxide** By: ____________

Line	**Item**	**Escalation: (1980 base)**	
1.	Plant location	Power:	18%/yr
2.	Process	Labor:	10%/yr
3.a.	Capacity, ____/yr	Capital:	8%/yr
b.	Capacity, ____/stream day	Steam:	10%/yr
4.	Operating factor, %	Raw materials:	8%/yr
5.	Capital investment	Taxes and insurance	6%/yr
a.	Battery limits, $		
b.	Off-sites, @ ______/%		
c.	Total, $		

6.	RAW MATERIALS					
a.	**Material**	**Raw material efficiency**	**Lb material/ lb product Theoret.**	**Actual**	**Unit price**	**Cost/lb of product**
b.		%				
c.						
d.						
e.						
f.						
7.	Total raw material cost:					

8.	UTILITIES			**Cost/lb of product**
	Item	**Usage**	**Unit price**	
a.	Electric power		____/kWh	
b.	Steam		____/000 lb	
c.	Water, cooling		____/000 gal	
d.	Water, process		____/000 gal	
e.	Fuel (specify)		____/____	
f.	Other (specify)		____/____	
9.	Total utilities			

10.	LABOR	
a.	Operating labor	
b.	Supervision	
c.	Percentage allocated cost @ ______%	
d.	Maintenance service	
e.	Yard service	
f.	Laboratory service	
11.	Total labor:	
12.	SUPPLIES:	
a.	Operating	
b.	Maintenance	
13.	Total supplies	
14.	Total direct costs, _____/_____	
15.	Administration @ ______%	
16.	Depreciation @ ______%	
17.	Taxes and insurance @ ______%	
18.	Cost of shipping, containers, etc.	
19.	Total indirect costs, _____/_____	

TABLE 5: **Mill B economics (hardwood)**

Total savings = $699,000/yr
Chemical savings = $215,000/yr
Steam savings = $484,000/yr

Assume:
ClO_2 cost is $0.42/lb
H_2O_2 cost is $0.395/lb (70% H_2O_2)
Steam cost is $3.25/1000 lb steam
Production is 600 a.d. tpd

TABLE 6: **Mill B economics (softwood)**

Total savings = $1,124,000/yr
Chemical savings = $272,000/yr
Steam savings = $852,000/yr

Assume:
ClO_2 cost is $0.42/lb
H_2O_2 cost is $0.395/lb (70% H_2O_2)
Steam cost is $3.25/1000 lb steam
Production is 600 a.d. tpd

TABLE 8: **Mill C economics**

Total savings = $932,000/yr
Chemical savings = $149,000/yr
Steam savings = $783,000/yr

Assume:
ClO_2 cost is $0.42/lb
H_2O_2 cost is $0.395/lb (70% H_2O_2)
Steam cost is $3.25/1000 lb steam
Production is 600 a.d. tpd

Zinc coatings: where, how to use them for best corrosion control

Topcoated zinc coatings can protect structured steel in most harsh mill environments; appropriate types to use in various areas are discussed

By ROGER J. TEGTMEYER

☐ Corrosion is obviously a major concern of mill maintenance, production, and engineering personnel. For example, a PULP & PAPER survey (Dec. 1980, p. 108) indicated that maintenance personnel considered corrosion their third-greatest maintenance problem. An earlier survey revealed corrosion to account for 20% of the maintenance budget—for both the process side and atmospheric corrosion. The cost of corrosion has been quantified as high as $1/ton of pulp. A wide range of corrosion problems, as detailed in Table 1, are made more complex by the proximity of processes, climatic conditions, mill management policies, and operating procedures.

The protection provided by zinc is vital to the preservation of steel surfaces in pulp and paper mills. However, to assure long service life, as much as 70% of steel surfaces protected by a zinc-rich film should be topcoated. An even higher percentage of such surfaces should be topcoated if they are exposed to prolonged chemical fallout during construction in an existing operating mill—even if they are to be installed in a relatively "benign" area. Thus, topcoats for zinc films are an integral component of protection in pulp and paper mills.

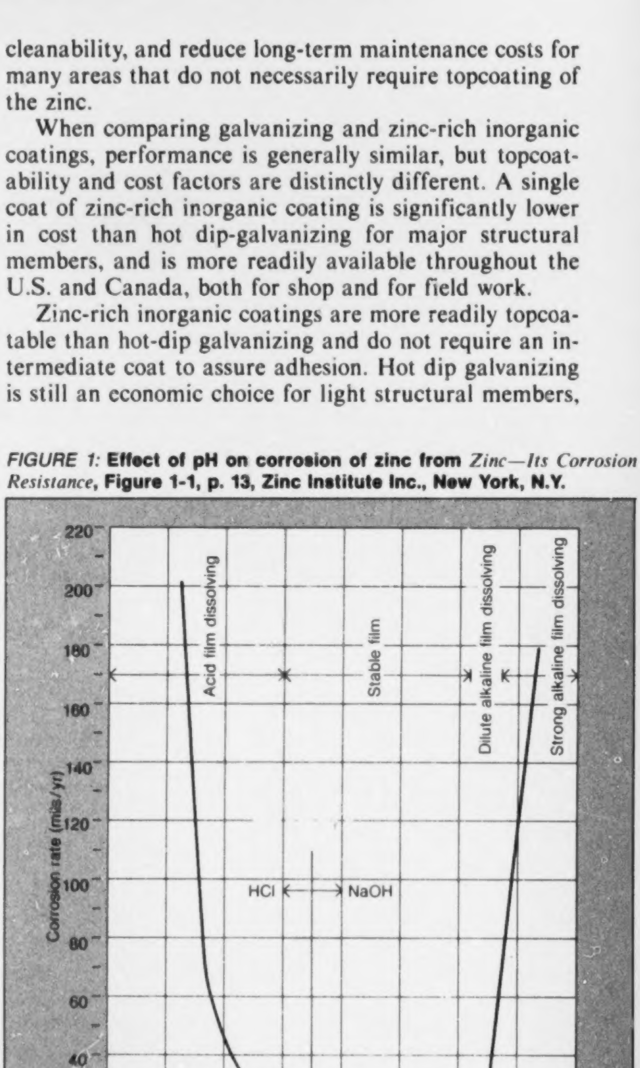
Zinc film protection

Many areas of a pulp and paper mill can be protected with just a single coat of zinc, either as hot-dip galvanizing or zinc-rich inorganic coating. Zinc provides protection from edge rusting, the most prevalent form of atmospheric corrosion which, if left unchecked, will contribute to total failure. However, even zinc films must be protected (topcoated) in some pulp and paper mill environments. Topcoating will also enhance service life, increase cleanability, and reduce long-term maintenance costs for many areas that do not necessarily require topcoating of the zinc.

When comparing galvanizing and zinc-rich inorganic coatings, performance is generally similar, but topcoatability and cost factors are distinctly different. A single coat of zinc-rich inorganic coating is significantly lower in cost than hot dip-galvanizing for major structural members, and is more readily available throughout the U.S. and Canada, both for shop and for field work.

Zinc-rich inorganic coatings are more readily topcoatable than hot-dip galvanizing and do not require an intermediate coat to assure adhesion. Hot dip galvanizing is still an economic choice for light structural members,

FIGURE 1: **Effect of pH on corrosion of zinc from** *Zinc—Its Corrosion Resistance*, **Figure 1-1, p. 13, Zinc Institute Inc., New York, N.Y.**



Mr. Tegtmeyer is manager of maintenance sales, Carboline Co., St. Louis, Mo.

floor plates, grating, handrail and toeboards, ladder cages, cable trays, pipe hangers, and possibly girts and purlins. However, because of the difficulties of overcoating, it is best restricted to areas not requiring topcoats. Overall, zinc-rich inorganic coatings, with appropriate topcoats where indicated, have distinct advantages for the protection of steel surfaces throughout pulp and paper mills.

A film of zinc protects steel in two ways: (1) it provides cathodic protection when the substrate is exposed to the environment, and (2) it acts as a barrier film between the environment and the substrate. More specifically these forms of protection are:

Galvanic effect. The stable form of iron in nature is iron oxide. When metallic iron is exposed to the atmosphere, it tends to oxidize (rust). When iron is coupled with a less noble metal (one having a greater oxidation potential) such as zinc, in the presence of an electrolyte, a galvanic cell is formed. In this cell, iron becomes the cathode and zinc the anode; thus iron is protected against oxidation corrosion and zinc is sacrificed (see Figure 1).

Barrier film protection. Zinc also protects steel by forming a barrier film between the corrosive environment and the steel. This is a function of the stability of zinc (with protective zinc carbonate on the surface) in a wide variety of environments. In strong acid or base environments, insoluble basic zinc salts are not formed, and the local corrosion rate becomes so rapid that the sacrificial zinc reaction is of little consequence or value.

Extensive testing by the Zinc Institute indicates that for immersion service the solution pH should not be below 5 or 6 or higher than 12 to minimize the local reaction rate (see Figure 1). The rate of local reaction and, thus, service life in relatively neutral atmospheric exposures is a function of the duration and frequency of moisture contact, rate of surface drying, and extent of chemical fallout.

Despite the amphoteric nature of zinc films, zinc can provide excellent protection in many exposures and is very useful in corrosion control of structures in pulp and paper mills. Zinc-coated steel is very resistant to damage in shipment. Normally, zinc-coated structural steel will suffer negligible damage; the film does not delaminate (the zinc tends to burnish into the steel surface). Because of the galvanic cell reaction, zinc films are able to protect damaged areas.

Of particular importance in the protection of structural steel, zinc films have the ability to protect edges. Figure 2 illustrates the tendency of structural steel, without the benefit of zinc, to develop rust breakthrough at the edges. Edge rusting leads to undercutting and premature failure of the system, rapidly escalating the cost of maintenance. A zinc film can effectively combat both edge rusting and undercutting.

Available zinc films

A film of metallic zinc must meet two important requirements to provide effective cathodic protection. The film must allow electrical contact between the metallic zinc and the metal substrate, and it must be capable of sacrificing freely without affecting the integrity of the film.

Two common forms of zinc films provide effective galvanic protection for industrial exposures. The historical form is galvanizing (specifically, hot-dip galvanizing) for structural shapes, piping, and some portions of equipment. This is applied by dipping in molten zinc, which

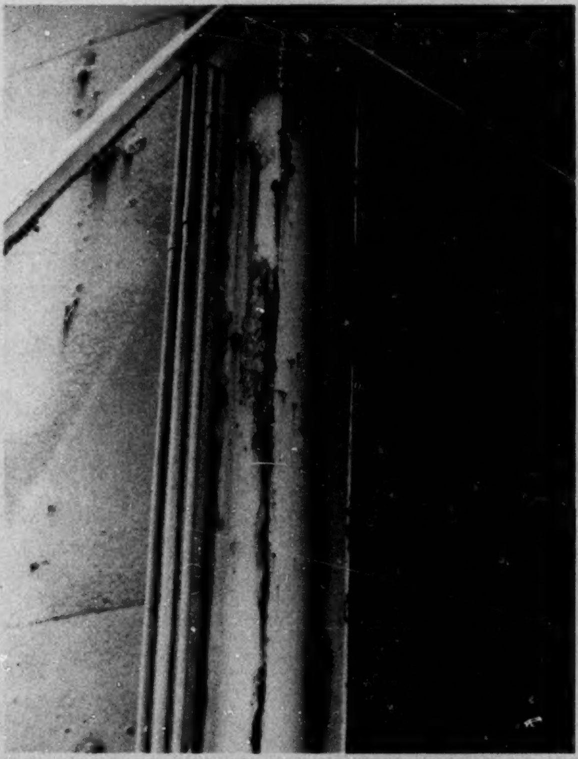


FIGURE 2: **Structural steel is susceptible to edge rusting and undercutting without protective coating.**

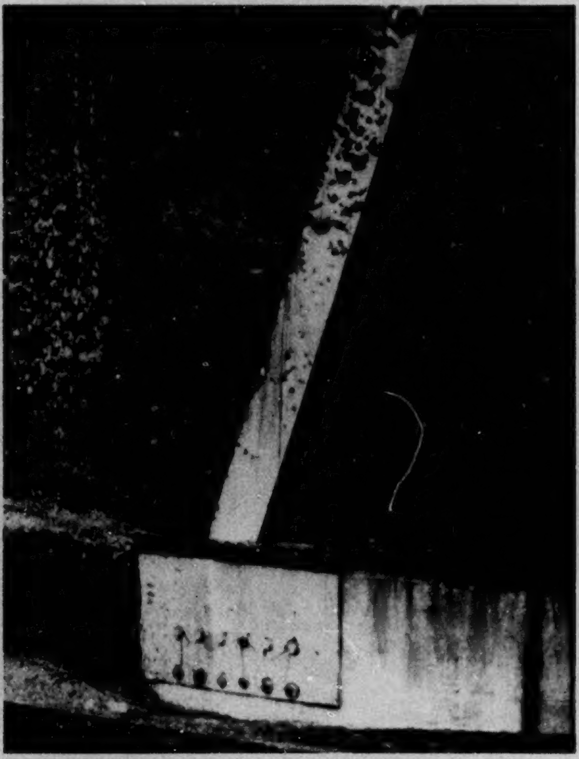


FIGURE 3: **Untopcoated zinc-rich ethyl silicate primer in causticizing plant of coastal pulp mill.**

typically produces a zinc-iron alloy film representing 50% to 70% of the total coating (which is topped by a layer of free zinc). A typical standard for after-fabrication galvanizing is ASTM A 123, with a specified average of 2.3 oz/ft^2, or 3.9 mils, for ¼ in. or thicker plates. A more modern approach, one that has been used increasingly since its development some 30 years ago, is the use of zinc-rich coatings with inorganic binders.

These coatings provide a film of zinc particles bonded by an inorganic vehicle that does not encapsulate or limit the electrical conductivity. These zinc-rich, inorganic coatings at a nominal dry film thickness of 3 mils (0.003 in.) are now used extensively in many industries, including pulp and paper mills.

It is generally recognized that a film of hot-dip galvanizing and a film of zinc-rich inorganic coating (with 86% minimum metallic zinc in the dried film) will provide equivalent performance (depending on the environment, one or the other has a slight advantage). Table 2 shows a cost comparison of zinc-rich inorganic coating and hot dip galvanizing. By general rule of thumb, zinc-rich inorganic coatings are more economical for all steel surfaces, except light structural steel with greater than 375 ft^2/ton, and for straight piping less than 10 in. in dia.

TABLE 1: **Typical pulp and paper mill exposures***

Area	Exposure	Typical pH range
Wood handling	Normally exterior exposure with splashing of water, abrasion and woodfiber buildup	5 to 8
Chipping and woodroom	Normally interior exposure with increased humidity and woodfiber buildup	5 to 8
Kraft or soda process pulping	Potential highly alkaline black liquor spills and white liquor fumes; very warm surfaces	10 to 14
Sulfite pulping	Fumes, spillage, and leaks of sodium magnesium or ammonium bisulfite and sulfate	2 to 11
Mechanical pulping	Generally humid interior exposure with steam wood acids and some fiber buildup	3 to 6
Semichemical pulping	Generally high humidity conditions due to steaming and steam vapor leaks and some fiber buildup	3 to 10
Pulp screening and cleaning	Extremely humid, often condensing environment with buildup and pulp and splash and spillage or immersion in diluted pulping chemicals	Dilution of pulping chemicals
Kraft or sulfite pulping bleaching	Generally a very humid interior exposure with chemical fumes and leakage of dilute bleaching chemicals which may include chlorine, chlorine dioxide, sodium hydroxide, sodium hypochlorite, hydrogen peroxide; also buildup of bleached or unbleached pulp	2 to 5-CL_2 and ClO_2 areas 11 to 13-NaOH areas. 8 to 11 hypochlorite areas
Mechanical pulping bleaching—hydrosulfite	Acidic vapors and fumes; high humidity	3 to 5
Papermaking	Very humid and water may spray at wet end; high humidity and very warm temperatures with frequent dry pulp buildup on surfaces above dryer section; frequently an area of condensation	3.5 to 6 which rise to 8 with alkaline sizing
Finishing and warehouses	Benign atmosphere with very little corrosive elements	Not applicable
Evaporators	Generally mild environment except for spills which corrosivity depends on type of pulping employed	10 to 12 for alkaline pulping and 3 to 8 for sulfite pulping
Recovery boiler	Normally interior exposure with warm surface temperatures from the boilers. Potential steam leaks, buildup of salt-cake and flyash in localized areas and may also have leakage of pulping liquor	Ranges from alkaline spillage of black liquor or boiler water to acidic condensation of fluegas or sulfite liquor leakage
Causticizing	Interior or exterior exposure which is primarily buildup of lime dust but also spillage of green liquor, lime mud, white liquor; very hot near lime kiln; acids may be employed to clean lime filter; high humidity in the filter and the slaker area	Normally 10 to 14
Tall oil recovery	Pine oil is hydrolized to rosin and other organic acids with sulfuric acid; normally exterior exposure.	1 to 6
Chemical generation and handling	Generally mild environment except at leakage or spillage of bleaching chemicals consisting of chlorine, chlorine dioxide and sodium hypochlorite	2 to 7
Power and steam generation	Warm, dry interior exposure exposed to fallout or leakage of fuel, particularly in hogged fuel boilers	4 to 10
Water pollution	Generally exterior exposure with high humidity, chemical fumes and water splash above clarifiers and filters	4 to 10 4 to 10
General mill environment—kraft mills	Generally alkaline fallout exposure with strong chemical fumes and fallout in localized areas, particularly near vents of highly chemical or humid areas and caustic fallout from the causticizing plant	3 to 10
General mill environment—sulfite plants	Generally acidic environment and fallout which may be concentrated in localized areas; may also have fallout of wood fibers from chip handling	2 to 8

*Adapted from *TAPPI Press Report,* "Maintenance painting programs for maximum return on investment," 1982.

Hot dip galvanizing and zinc-rich inorganic coatings have specific advantages to the user. The following discusses the characteristics, advantages, and drawbacks of each:

Zinc-rich inorganic coatings. A zinc-rich inorganic silicate coating is simply a film of powdered metallic zinc bonded, but not encapsulated, by a silicate binder that generally has a very high efficiency of zinc availability. Zinc-rich inorganic silicate primers are available in a variety of forms: solvent-based and water-based, self-curing and post-cured, two-package and single-package. The most popular for corrosive atmospheres is a two-component material. For this discussion, however, "zinc-rich inorganic coating" is sufficient designation. Zinc-rich inorganic coatings have been used for the past 20 years throughout the U.S. and Canada for all areas of pulp and paper mills, as well as for entire grassroots mills. Results have been excellent.

In highly industrial areas, the Steel Structures Painting Council reports that zinc-rich coatings provide significantly longer protection than unpainted galvanized steel. Figure 3 shows a zinc-rich, inorganic primer on a blowtank support structure, untopcoated since 1977 with no deterioration. This is typical of experience with untopcoated, zinc-rich primers in recovery boilers since 1964. However, where zinc-rich inorganic primers are left untopcoated permanently, it is often recommended that film thickness be increased to 4 or 5 mils in one coat.

Hot-dip galvanizing. Hot-dip galvanizing also can provide economical protection for many steel surfaces of a pulp and paper mill. As with zinc-rich inorganic coatings, untopcoated galvanizing will provide excellent protection in marine exposures and relatively dry exposure to chemicals within a pH range of 5 to 10. Many paper mills have employed hot-dip galvanized items such as conduit hangers, switchgear steel, and miscellaneous steel with excellent service life.

TABLE 2: **Cost comparisons[1] (based on 250 ft^2/ton)**

Self-curing zinc-rich inorganic coating		**Hot dip galvanizing**	
In-shop	**Cost**	**In-shop**	**Cost**
SP-6 commercial blast (centrifugal blast equipment)	\$0.25/ft^2	Acid pickling and average 1½ oz/ft^2 galvanizing	\$0.10/lb
Cost of primer at 3 mils (30% loss)	\$0.11		
Application labor	\$0.22		
Total in-shop cost	\$0.581/ft^2 or \$145.25/ton	Total in-shop cost	\$0.10/lb[2] or \$375.00/ton
Topcoating in field[3]		**Topcoating in field[3]**	
Field touch-up	4	Field touch-up	4
High build epoxy topcoat at 4 mils		rve wash primer at 0.5 mils	
Labor	\$0.19	Labor	\$0.19
Material (30% loss)	\$0.091	Material (30% loss)	\$0.070
		High build epoxy topcoat at 4 mils	
		Labor	\$0.19
		Material	\$0.19
Total for field topcoating	\$0.281/ft^2 or \$70.25/ton	Total for field topcoating	\$0.64 or \$160.00/ton
Total for in-shop priming and field topcoat	\$215.50/ton	**Total for hot dip galvanizing and field topcoat**	\$535.00/ton

1. Labor and material costs for coatings are based on the NACE Corrosion/82 Paper No. 145 by A. H. Roebuck & G. H. Brevoort
2. Approximate cost of \$0.10/lb for 1.5 oz/ft^2 zinc is an average cost figure from 1979 and is likely to be higher in 1982. The 1.5 oz/ft^2 level of zinc protection is commonly specified but only 65% of the protection recommended in ASTM A123 of 2.3 oz/ft^2 for ¼-in. or thicker plate
3. Assumes topcoating after erection, but at ground level; figures for high levels topcoating or more complicated structures would increase costs proportionately for both systems
4. Touch-up requirements for both will be negligible

Hot dip galvanizing requires that certain design criteria be followed. Stiffeners, gusset plates, angle clips, and other weldments on structural members must be seal-welded. If one seal weld is bad, accelerated corrosion may occur due to penetration by the acid pickling bath. Tubular fabrications and hollow structurals must be properly vented. According to galvanizing industry specifications, high strength steels (specifically high silicone steels) must not be hot-dip galvanized.

Finally, fabricated structural members, particularly those dipped one end at a time to coat the whole beam, will often warp and twist in the molten zinc bath, causing difficulties in erection. Guidelines for minimizing distortion and warpage are provided in ASTM Recommended Practices A384[7]. Of course, corrosion prevention should be a design criterion for all structures.

Topcoat requirements

The primary advantage of a zinc film, compared with any other protective coating, is its reactivity, i.e., its ability beyond that of a barrier film to provide galvanic protection. It is that reactivity, however, that necessitates topcoating to isolate the environment from the zinc. Table 3 lists areas where topcoats may be necessary to ensure long term protection of the substrate. In many mill areas where the pH range is relatively neutral and wet-dry cycles are infrequent, no topcoat is required for long service life (in excess of 20 years).

In other areas the surface may be exposed to periodic condensation (e.g., paper machine room) oxidizing atmospheres (e.g., bleach plant), or caustic buildup (e.g., caustic plant). The zinc will be subject to attack in these areas. For example, service life of the protective zinc film is substantially affected by the wet-dry cycles on struc-

TABLE 3: **Guidelines for topcoating zinc coatings**

Area	**Topcoat recommendation**
Wood handling	Suggested
Chipping and woodroom	Suggested
Alkaline pulping	Recommended
Sulfite pulping	Recommended
Mechanical pulping	Suggested
Semichemical pulping	Suggested
Pulp screening and washing	Recommended
Bleaching–kraft and sulfite pulp	Required
Bleaching–mechanical pulping	Required
Papermaking	Recommended
Finishing and warehousing	Not required
Evaporators	Suggested
Recovery boiler	Suggested
Causticizing	Suggested
Tall oil recovery	Recommended
Chemical generation and handling	Recommended
Power and steam generation	Not required
Water pollution control	Not required
General mill environment-kraft and sulfite mills	Recommended

Note: The above recommendations are based on the assumption that the areas named are separate entities and are protected from fallout from other areas. If not, the recommendation for topcoating should be based on the most aggressive exposure in the area.

tural surfaces common to pulp mills and overhead structural steel of paper machine rooms.

If condensation evaporates quickly from these surfaces, corrosion is not severe due to the protective zinc carbonate film. However, severe corrosion can occur when water remains in contact with the zinc under high humidity conditions, particularly in poorly ventilated areas.

Topcoating will protect the zinc film and preserve cathodic protection of bare metal and resistance to undercutting. Experience has shown that maintenance before significant rusting has occurred is the most cost-effective maintenance cycle.

Sandblasting of substantially deteriorated surfaces is extremely costly (as much as 50% of the overall cost of repainting). In many areas of a paper mill, sandblasting is impractical, if not impossible. Thus, initial topcoating may be the best way to protect a zinc investment and reduce maintenance costs over the many years of expected service.

Topcoatability

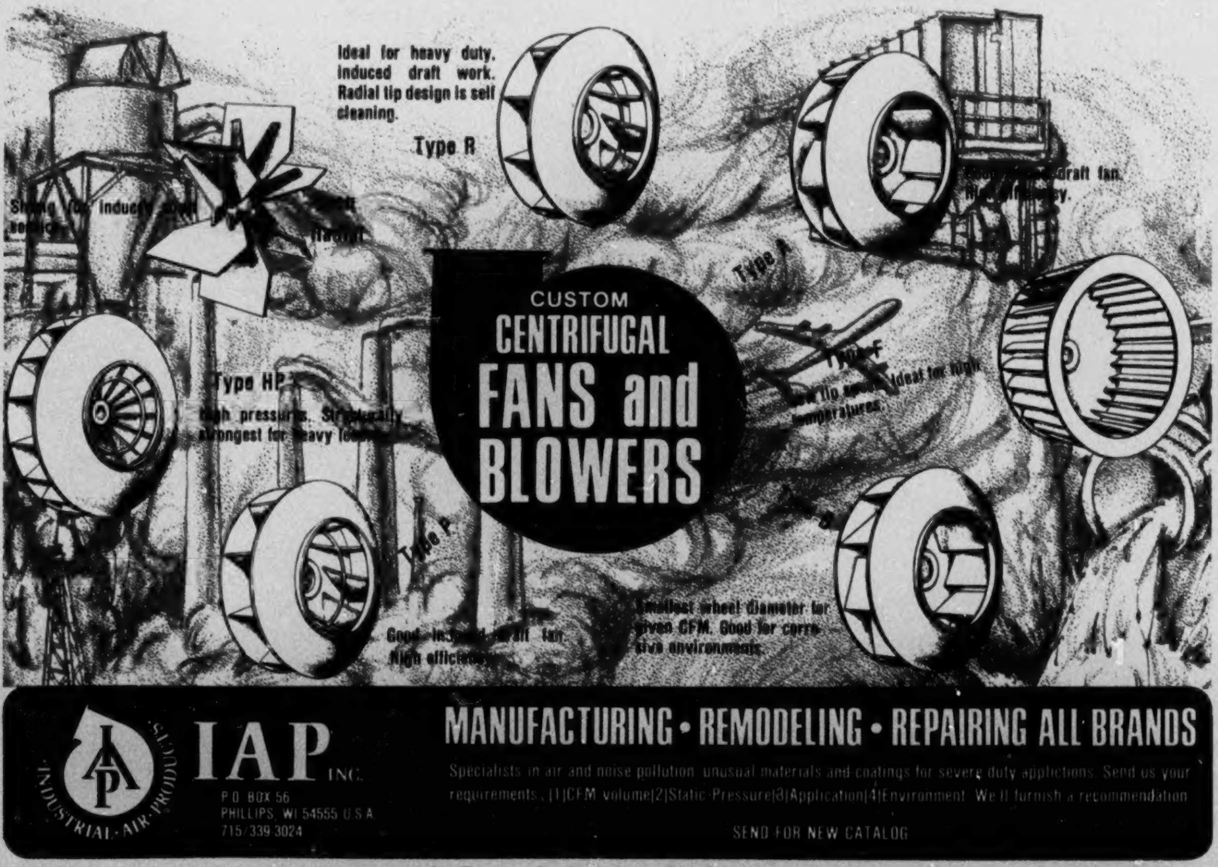
Significant differences exist in the topcoatability of zinc-rich inorganic coatings vs hot-dip galvanizing.

Zinc-rich inorganic coatings are readily topcoated. Because they are generally topcoated, they are frequently referred to as primers. With a high-build epoxy polyamide topcoat, as recommended in a recently released TAPPI report on protective coatings for the pulp and paper industry, steel systems have exhibited many years of excellent service in virtually all areas of both sulfite and kraft mills.

Topcoating is of such value to overall performance that often a lower zinc loading, such as 75% zinc in the dried film, will not compromise long-term performance. Zinc-rich inorganic coatings with topcoats can be very economical. For example, a system of steel primed in the shop, with field touchup and field topcoat, totals \$0.86/ft^2 or \$215.50/ton. This compares very favorably with the cost of topcoated galvanizing even at 1.5 oz of zinc/ft^2.

Topcoating hot-dip galvanizing is not a simple matter. Normally, two methods are used to achieve good adhesion of topcoats: phosphoric acid wash or a phosphoric acid/polyvinyl butyral (PVB) wash primer. However, both of these methods have drawbacks that are made worse by the chromate treatment used to inhibit early salting of galvanized surfaces.

The treatments should be omitted if galvanizing is to be topcoated when new. Phosphoric acid washes can yield inconsistent results because of the lack of visual confirmation of treatment, allowing skipped areas. The PVB wash primers are more commonly employed and, if applied at the recommended 0.5 mils, can yield excellent results. However, the configuration of structures contributes to excess film thickness. Films in excess of one mil tend to result in delamination of the topcoats, particularly cross-linked topcoats. Topcoatability and adhesion of topcoats improve with aging and formation of the insoluble zinc salts, but thorough cleaning is necessary so that topcoats are not also applied over soluble salts. ☐



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Inland Container's anaerobic effluent system working well

First paper industry anaerobic effluent treatment system in North America is highly successful at Inland Container's board mill in Newport, Ind.

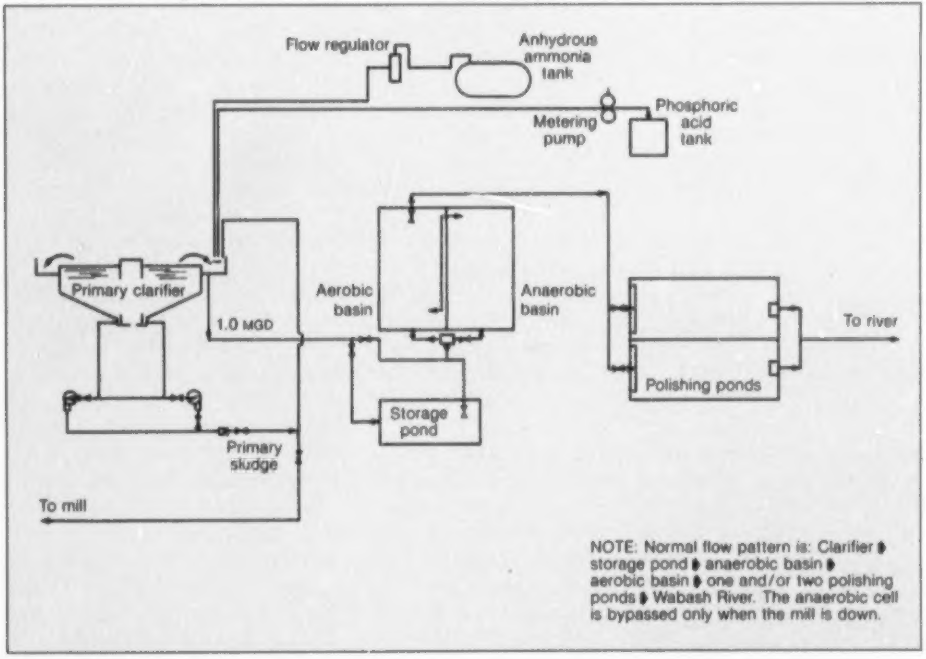
By CHARLES J. PRIEST

☐ Significant engineering advances in the use of anaerobic digestion for waste treatment have been made in recent years. Today, anaerobic digestion, e.g., without the use of oxygen (air), is widely used by municipal plants to stabilize secondary sludge (although in the U.S. it has not been applied directly to municipal effluent). However, only in the past few years has industry seriously considered direct anaerobic treatment.

Due to the original applications of anaerobic digestion for stabilization of municipal wastewater sludges, this process was believed very slow compared with aerobic treatment. Eventually, it was found that this erroneous understanding was due to the nature of the organic feed to both processes. Aerobic biological processes treat the simple organic substrates that are soluble or colloidal in nature and easily degraded. However, the anaerobic digestion processes are used to treat the sludges, which are more complex, particularly the difficult-to-degrade bacterial cells generated profusely by the aerobic process.

In effect, anaerobic digestion is really the "workhorse" of the municipal treatment plant. Approximately one-third of the influent biological oxygen demand (BOD) is removed in primary sedimentation and sent to the anaerobic digester. Of the remaining BOD which enters the aerobic process, about half is converted to carbon dioxide; the remainder is bacterial cells, which are also sent to the anaerobic digesters. Therefore, the anaerobic proc-

FIGURE 1: **Flow diagram of anaerobic/aerobic effluent treatment at Inland Container Corp.**



NOTE: Normal flow pattern is: Clarifier ➧ storage pond ➧ anaerobic basin ➧ aerobic basin ➧ one and/or two polishing ponds ➧ Wabash River. The anaerobic cell is bypassed only when the mill is down.

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ess must stabilize about two-thirds of all pollution entering a conventional municipal plant.

However, in the evolution of waste treatment, a great need existed to convert the soluble and colloidal fractions into a form that could be separated by gravity settling. Therefore, the penalty of high secondary sludge production was "masked" by the fact that an acceptable effluent could be produced. Initially, ample land and oceans were available to dispose of sludge readily, and energy was cheap. This situation has changed drastically. In recent years, sludge disposal problems have been a significant factor in the growing interest in anaerobic digestion.

The anaerobic process

A primary obstacle to direct application of anaerobic treatment is the lack of a fundamental understanding of the biochemistry and microbiology of the process.

This treatment of sludge, a complex organic matter, involves a sequential process of hydrolysis, acid formation, and methane fermentation. The microbial population is comprised of many different anaerobic bacteria which maximize chemically bound oxygen (not dissolved oxygen). If present in the waste, the nitrate ion (denitrification) and sulfate ion (sulfate reduction) are also used for the oxidation of organic waste. In balanced digestion, the separate steps of the process occur simultaneously.

Anaerobic digestion combines a high degree of waste treatment with a low production of biological solids. Growth of the methane bacteria population is very small and is dependent on the type of effluent being treated. Highest sludge growth is obtained with carbohydrates and the lowest with volatile fatty acids.

Stabilization attained in anaerobic treatment is directly related to methane production. Anaerobic bacteria grow slowly and are sensitive to environmental changes (especially methane bacteria). Therefore, insight into the effect and possible interrelations of various environmental factors should be considered.

The three temperature ranges for anaerobic digestion are: 122°F to 149°F, 68°F° to 113°F, and below 68°F. Not only may the process move faster under the higher temperature conditions, but it is often presumed to be more sensitive in that range. With simple substrates, the process still proceeds at temperatures as low as 50°F.

The optimum pH range for anaerobic digestion is 6.8 to 7.2, but the process still proceeds successfully in the 6.0 to 8.0 range. In digestion of the more complex substrates, it should be noted that acid forming organisms are significantly less susceptible to acidic pH conditions than the methane bacteria. Although the nutrient requirements in anaerobic treatment are low, the minimum amount of all essential nutrients must be present in an available form. If not, poor chemical oxygen demand (COD) removal will result. With a view to the process, a slight overdose of nutrients should be considered.

TABLE 1: **Monthly average data before and after changeover**

Year	Month	Lb BOD/day influent	Lb BOD/day removed anaerobic & aerobic	Efficiency % total system
1976	Average	8,955	Aerobic only—7980	89.1
1977	Average	10,795	Aerobic only—9481	87.8
1978	Average	15,700	Aerobic only—13,368	85.1
1979*	Average	20,256	Combined anaerobic and aerobic—18,604	91.8
1980	Average	17,945	Combined anaerobic and aerobic—16,936	94.4
1981	Average	19,366	Combined anaerobic and aerobic—18,929	97.7
1982	Average**	23,418	Combined anaerobic and aerobic—22,910	97.8

*System converted to anaerobic digestion with aerobic polishing

**January–July 1982

Anaerobic treatment features

Features of the anaerobic treatment process include very low energy requirements, production of methane as a useful end product, low production of secondary sludge, low nutrient requirements, and high organic loading rates (much higher than with aerobic digestion). Another important feature for industrial concerns is that well-adapted anaerobic sludge, stored at temperatures in the range of 39°F to 68°F, does not deteriorate.

Although the anaerobic process is rather sensitive to specific environmental factors, it is very capable of accommodating itself to environmental alterations. If operated within its limits with respect to loading rate, pH, buffer capacity, and temperature, anaerobic digestion is a stable and effective treatment method. Parameters of prime interest in controlling the process are pH, gas production, gas composition, temperature, and active solids washout. Automatic control of the process can be accomplished with relative simplicity by maintaining proper balance between volatile acids and alkalinity.

Inland Container installation

Requirements for anaerobic digestion of effluent at Inland Container Corp.'s Newport, Ind., mill were established through pilot studies. Permission to convert to an anaerobic/aerobic system was obtained from the state in November 1978. The changeover was made immediately.

The mill's effluent system originally consisted of a primary outflow pond, two aeration basins (5 million gal each) and two polishing ponds (3 million gal each). The polishing ponds were operated in parallel or separately, depending on requirements. They were used for settling and removal of secondary sludge. The accumulated secondary solids in the polishing ponds were applied to farmland by a spray irrigation system. Since effluent quality improved significantly after the changeover, spray irrigation is no longer used.

The first step in the changeover was preparation of one of the two existing aeration basins for conversion to an anaerobic cell. All aeration equipment was removed from the basin, which was then decanted and seeded with biomass that had been allowed to become acclimated to anaerobic conditions. It was obvious that normal atmospheric temperature variations from summer to winter would adversely affect the efficiency of the anaerobic cell. To overcome this, the surface was insulated with Styrofoam sheets. The other basin continues to provide aerobic treatment. It handles the effluent flow from the anaerobic cell to provide any necessary final treatment.

As shown in Figure 1, outflow from the primary clarifier goes to a storage pond, then to the anaerobic cell. Sludge from the bottom of the primary clarifier is sent to the mill stock system. The anaerobic cell overflows to the aerobic basin for aeration, which discharges to two parallel polishing ponds for settling the secondary sludge.

Results obtained

From January to October 1979, the mill was learning to control the process, modify flow patterns, and establish a stable system. In October 1979, the anaerobic cell destroyed 80% of the BOD entering it. The effluent system's overall efficiency has been well over 90% since June 1979. For the past 16 months, efficiency (including the aerobic phase) has been 98%.

Table 1 shows annual averages of influent BOD, effluent BOD, and percent BOD destroyed. The influent BOD concentration has shown almost a continual increase since startup. It was 843 mg/l in 1975, and rose to 2300 mg/l by the end of 1979. For the past two years, concentrations have been 2400 to 3000 mg/l. Effluent BOD, on the other hand, averaged 175 to 187 mg/l from 1975 through 1977, and 220 mg/l in 1978. From June 1979 through August 1980, it averaged 98.6 mg/l. In 1981, the average effluent BOD was 53.2. From January to July 1982, it averaged 36.2 mg/l.

Prior to installation of the anaerobic system, the polishing ponds required emptying of sludge twice each year. Approximate volume was 12 million gal/year. Since the changeover to an anaerobic/aerobic system, the mill has had to remove only 3 million gal of sludge every 2.5 years. Thus, sludge handling after the changeover has been approximately one-tenth what it was with aerobic operation only.

The anaerobic basin has now been in operation for four years. The BOD destroyed by the anaerobic basin to date has theoretically produced 2 million lb of anaerobic bodies. At a 10% solids concentration, the anaerobic cells would be half full of sludge and require emptying soon. Actual measurements do not confirm theory. Samples taken 1.0 to 1.5 ft off the bottom show 5% to 6% solids. The anaerobic biomass is either settling to a very high degree or destroying itself. A three-week study of sludge destruction showed a 70% solids reduction (5.2% to 1.6% solids). The mill has not been able to obtain samples 6 in. to 1.0 ft off the bottom since the sampler will not penetrate the mass.

Other benefits

Anaerobic digestion has resulted in benefits other than improved effluent quality. These include:

- An increase in production with improved effluent quality
- A potentially usable byproduct (about 200,000 ft^3/day of methane gas)
- A reduction in nutrient feed requirements
- Aerobic sludge generation less than one-tenth of that generated using aerobic digestion alone
- Anaerobic pilot plant data were transferable to a full-scale system
- Anaerobic system is easy to control (daily tests give necessary information to maintain an efficient cell)
- Substantial energy savings (aeration horsepower was reduced from 420 to 120; some aeration is still required for polishing and stabilizing)
- The anaerobic cell, with moderate changes, accommodates two to three times of present waste load. ☐

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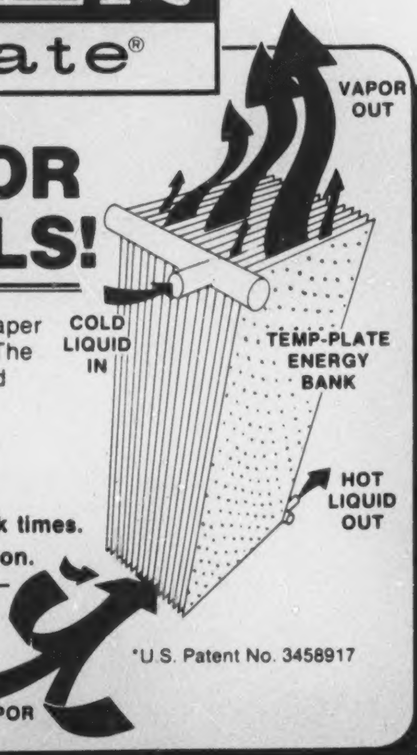


Red ink, slow rise in shipments on

Market pulp demand should head up in the U.S. and Far East, but European demand will remain weak; CTMP market pulp has potential for growth

By DAVID R. ALLAN, News Editor

☐ Tough sledding will continue to be the rule for the Canadian pulp and paper industry in 1983 despite the approach of an economic recovery in both Canada and the U.S., delegates to the recent annual meeting of the Canadian Pulp & Paper Assn. in Montreal were told.

Outgoing and incoming chairmen of the group painted a bleak picture in a press conference they held with association president **Howard Hart**. New CPPA chairman **John Fisher**, chairman of Fraser Inc., predicted that investment by the industry will drop by about 40% from the C$2.8 billion expended in 1982. He also cautioned executives to expect financial losses through the first three quarters of the year—with performance in the fourth period determining whether the industry is in the red for the year as a whole.

Retiring association chairman **Ray Pinard**, executive vice-president of Domtar Inc., warned that "if we are to continue our spending programs to improve productivity and competitiveness, we must search for some cost relief." That relief appears to be available only through a rollback in the 1983 portion of the 1982-83 wage pact signed with paperworkers last year, he added.

The industry will probably approach Canadian Paperworkers Union soon with an official request to reopen talks on the second year of the contract in order to slash the 10% wage hike now slated for 1983, Pinard said.

Some cost relief in fuel prices has been seen, and Pinard noted this trend led some Quebec mills to abandon plans to switch boilers from bunker fuel to natural gas.

Newsprint price outlook

But more important for the industry than reduced energy costs is the economic condition of its customers, and Pinard doesn't expect a major turnaround in current newsprint operating conditions until 1984. He does see a possible return of newsprint prices to US$500/metric ton from the current $468.50 level by the year's end, assuming a vigorous rebound in North American economies.

But that vigorous rebound is by no means certain in the minds of most speakers at the conference. CPPA woodpulp section manager **Brian McClay** gave one of the most optimistic presentations, saying that "I believe that the subdued recovery expected by many economic forecasting groups is unduly pessimistic."

But even McClay admitted that "it is a gross understatement to say that the signals coming from the U.S. Administration are confused." His general conclusion, however, is that "the U.S. economy is positioned to experience a more robust recovery than many dare predict."

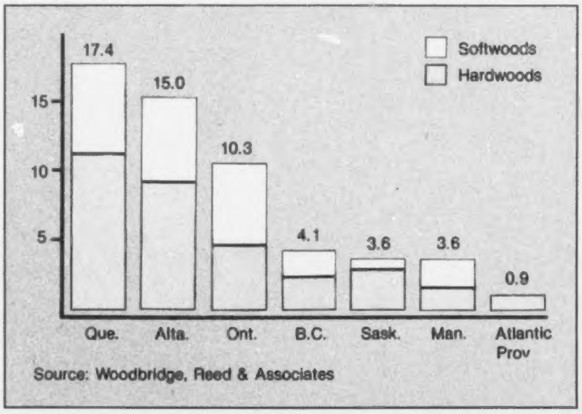
McClay and others believe the U.S. recovery will pull Canada out of its current economic doldrums. But Univ. of Toronto economist **Carl Beigie** suggested Canada cannot count on any of the four most popular engines to power its comeback: government stimulus, consumer spending, U.S. imports, and capital spending.

As a result, Beigie warned, "the economy . . . will recover, but extremely slowly," such that Canada's unemployment rate will end 1983 higher than it is now. That, in turn, will act to restrain consumer spending.

In looking at Canada's long-term competitiveness worldwide, Beigie suggested Canada let its dollar "drift" down now, before recovery is fully under way. A currency level that "makes sense" to him would be US$0.75 to the Canadian dollar.

Royal Bank of Canada economist **Stephen Prime** predicted the U.S.-Canadian exchange rate will remain relatively stable for the next two years, while the Japanese yen is appreciating against the two currencies. The Swiss franc and the deutsche mark will also prove strong, in contrast with the weak French franc, British pound, and Italian lira.

FIGURE 1: **Incremental fiber supply in Canada includes large volumes of hardwoods, especially in Quebec and Alberta** (million m³/year)



Source: Woodbridge, Reed & Associates

horizon for Canadian mills in 1983

Canadian economic performance

Canada's gross national product will rise about 0.5% in 1983, Prime believes, in contrast with a growth rate more than four times as high in the U.S. On the other hand, Canada's three-month commercial paper rates will drop below 8% by year's end, from 10.2% in January and 16.5% in early 1982. Corporate profits in Canada will shoot up by 40%, although from depressed levels, while the GNP price index will drop to 7.4% in 1983 and 5.8% in 1984, from 10.6% in 1982. U.S. housing starts will reach 1.3 million units in 1983 and 1.6 million in 1984, while Canadian starts climb to 160,00 and 185,000, respectively.

If that kind of recovery can be sustained, McClay thinks U.S. paper demand will rise somewhat faster than GNP. He expects a rise in Canadian pulp shipments to the U.S. of 12%, with some inventory rebuilding at paper mills possible in the second quarter.

On the other hand, Western European paper and paperboard output probably won't rise significantly until as late as the fourth quarter. Pulp inventory rebuilding will help push Canadian shipments to Europe up slightly, while a fall in oil prices would improve the overall picture on the continent.

Canadian shipments to Japan. A slight increase in Canadian pulp shipments to Japan is possible in the first half, increasing "considerably" in the second half as the yen appreciates in value. On the other hand, shipments to most of the Third World should remain static, dropping by mid-year and picking up after that.

Without a big recovery in any of its customer countries, Canada is likely to see a market pulp shipment rise of just 10%, from depressed levels, with operating rates "unlikely to cross the 80% level until the third quarter."

The picture in the European market may be even bleaker—at least in the long term—if purchasing director **Michael Gadd** of Britain's Reed Paper & Board Ltd. is right. Gadd described Western Europe's challenge as being one of "how we profitably manage overcapacity."

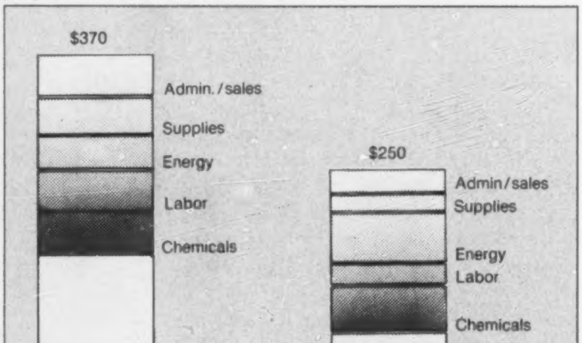
European paper capacity is expected to rise by about 8% by 1986, Gadd noted, adding, "we start the period already with excess capacity." The region is now underconsuming its paper and board capacity by almost 20%, and that—on top of an 8% capacity increase—spells trouble for the industry in the late 1980s and beyond.

Warning on European competition

While capacity is rising, Gadd predicts that "we are not expecting to see any major rise in demand for paper and pulp," adding that "there should be no more major investment in capacity for the immediate future if the rest of us are to survive."

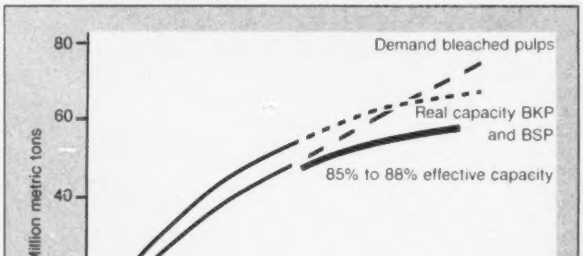
Complicating the picture is the current market situation, including the recent depreciation of Scandinavian currencies. And with European Community tariffs on Scandinavian pulp and paper shipments disappearing at

FIGURE 2: **Estimated production costs for a bleached softwood CTMP mill are only about two thirds of costs for a similar kraft pulp mill** (1982 U.S. $/a.d. metric tons)



Source: Woodbridge, Reed & Associates

FIGURE 3: **Demand for bleached pulps worldwide is projected to begin outrunning supply in the 1990s**



Source: Woodbridge, Reed & Associates

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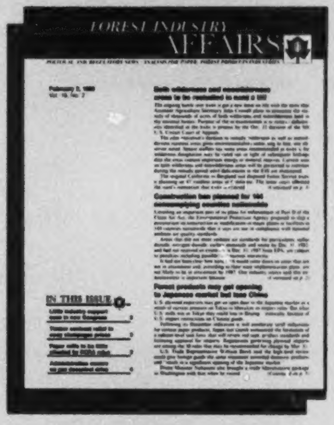

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the end of this year, any "cutthroat competition" on the part of Scandinavian mills or others could cause the EC to rebuild those tariff walls, he noted—muddying the waters in the future.

CTMP's market pulp potential

Recent technological advances have made chemithermomechanical pulp (CTMP) a potential replacement for bleached kraft pulp in integrated mills and as market pulp, and up to 15 CTMP mills could economically be built under present conditions in Canada alone, according to a study presented to the meeting by **Peter Woodbridge** of Woodbridge, Reed & Associates, Vancouver, B.C. The report was prepared for Environment Canada.

Readily accessible timber reserves and underutilized chip supplies make room for 13 such mills in western Canada and 2 more in central Canada, with potential for another 11 and 4, respectively, over the longer term once improvements in transport and power systems are made, the report concludes.

Nonintegrated printing/writing paper and tissue mills in the northern U.S. are among the most important potential customers for market CTMP, according to the report, with western Europe, Japan and South Korea also attractive possible markets.

South Korean demand. In the Japanese market, for example, Woodbridge predicts that imports of "high-quality, high-yield pulps" such as bleached CTMP could rise to 250,000 metric tpy, from 85,000 tons in 1980. In South Korea, demand for such pulps should hit 115,000 metric tpy in 1985 and 270,000 tpy in 1990—most of which will have to be imported.

Market CTMP mills would have to approach their customers in a different way from that of market kraft pulp mills, he notes, with the technical advantages of the pulp for a particular paper mill's needs the major selling advantage. Thus, marketing would be on a "technical" rather than a commodity basis. He adds, "the pricing of these pulps will be somewhat dependent on end-use."

Woodbridge estimates that bleached CTMP sold in the northeastern U.S. should be priced US$50/metric ton below that of southern hardwood bleached kraft pulp, while in Asia the price would have to be 75% to 80% of softwood bleached kraft and $50/metric ton less than hardwood BKP.

CTMP mill startup cost. Such price advantages are facilitated by the lower cost of a CTMP mill, the study notes, with total investment required at startup for a 550-metric-tpd bleached CTMP mill set at about C$140 million, well below costs for a comparably sized kraft pulp mill.

Production costs for such a mill in 1982 would have been about US$250/metric ton for softwood CTMP, compared with $370 for softwood BKP, Woodbridge estimates. With selling prices for bleached CTMP of C$580/metric ton, Woodbridge estimates a 20% to 23.5% return on equity for such a mill, depending on wood costs.

Good technical qualities are achievable with optimal use of present technology, the study claims, with 75% brightness or higher possible through peroxide bleaching. Yields for CTMP that are twice that of BKP reduces wood costs, he notes, while economically accessible timber reserves in Canada are much larger in the hardwood category than in softwood—and hardwood CTMP pulps can be used in production of high-quality printing/writing papers, the study claims. ☐

Aluminum sulfate markets continue to sag

By BARRY SHOCKETT

The first quarter of 1983 showed no significant increase in total demand for alum in the U.S. Pulp and paper usage had also not yet begun to rise. The expected economic recovery forecast for mid-year, however, could boost requirements for the full year.

With the exception of sewage treatment uses, alum markets in Canada have also remained sluggish. However, with the move by the city of Calgary to employ alum for phosphate removal, sparking the construction of a plant by United Chemicals, this end-use grew an estimated 10% in 1982.

U.S. statistics, 17% Al_2O_3 (000 short tons)

	1979	1980	1981	1982e
Nameplate capacity*	2400	2300	2500	2565
Production	1313	1182	1206.5	1200
Shipments	1216	1151	1205	1190
Imports	24	26.8	27	22
Exports	26.5	11.6	28	7
Apparent consumption	1213.5	1166	1204	1205

*Based on industry estimates of operating rates
Source: Bureau of Census, U.S. Dept. of Commerce

Canadian statistics, 17% Al_2O_3 (000 short tons)

	1979	1980	1981	1982e
Nameplate capacity	257	275.5	275.5	280.5
Production	193.5	198	196.5	193.5
Total demand	175.5	177.5	176.5	175
Internal paper sizing	53	54	52	49.5
Other pulp/paper	54	53	53	48.5
Municipal water sewage	51.5	53	54.5	60
Misc.*	17	17.5	17	17
Exports	22	22	23	21
Imports	4	1.5	3	2.5

*Including pigments

ALUMINUM SULFATE

UNITED STATES

Uses: Aluminum sulfate is used by the pulp and paper industry for internal rosin sizing, pitch control, and water treatment. Nonpaper end uses include potable water and wastewater treatment.

Demand: Pulp and paper industry usage has been relatively unchanged for the last two years. An estimated 615,000 short tons were consumed in 1981 and 1982. The quantity employed for water and sewage treatment was also unchanged in those years, with usage at about 458,000 tons.

Sources: American Cyanamid Co., Allied Chemical, and Stauffer Chemical Co. account for 75% to 80% of industry capacity. There are about 15 producers. Allied Chemical is building a third plant in Florida, due onstream in mid-1983.

Availability: There are no shortages on the immediate horizon, and industry operating rates are below 50%. History: 1983 to 1979, market all years.

Pricing: Prices have remained constant since July 1981, although discounting is occurring in some areas. Pricing history: 1982, \$133/ton, bulk, liquid (17% Al_2O_3), f.o.b. works, freight equalized; 1981, \$121 to \$133/ton; 1980, \$101 to \$109/ton; 1979, \$89 to \$94/ton.

Forecast: Total alum demand is not expected to increase before mid-year, and could reach the 1.3-million-ton level in 1983. Usage by the pulp and paper industry could also increase by 7% to 8% for the full year. Based on raw materials cost, alum prices should increase in the second quarter. However, soft markets will probably mean a price hike will not occur much before late summer.

CANADA

Uses: The pulp and paper industry uses alum for rosin sizing, pitch control, process water treatment, and pH control. Other uses include municipal water treatment, sewage treatment, pigments, and synthetic crude production.

Demand: Pulp and paper industry alum usage is split evenly between rosin sizing and other uses, and the industry makes up 61% of total demand. In 1982, mill demand decreased to about 98,000 tons, down from 105,000 tons used in 1981. Internal rosin sizing consumed 49,500 tons in 1982 and 52,000 tons in 1981. Total demand in 1982 dropped to 175,000 tons, vs 176,500 tons in 1981.

Sources: Canada has 14 plants and 5 producers. Between 75% to 80% of total capacity is held by Alchem Smelters & Chemicals, and Allied Canada's Allied Chemicals Div. Next is Inland Chemicals (C-I-L subsidiary), then United Chemicals and Borden Chemicals.

Availability: No supply problems are foreseen through the end of the decade. History: 1983 to 1980: market; 1979: market to tight.

Pricing: There was one price change in 1982 (on Jan. 1) when bulk, liquid (70% equivalent Al_2O_3) rose to \$131.54/ton, f.o.b., plant. A 6% boost had been announced for the beginning of 1983, but it was postponed for Apr. 1. Pricing history: 1983, \$131.54 to \$139.71/ton; 1982, \$131.54/ton; 1981, \$100.70 to \$119.75/ton; 1980, \$86 to \$100.70/ton; 1979, \$79 to \$86/ton; 1978, \$73/ton.

Forecast: Despite the 1982 drop in demand by the pulp and paper industry, usage should reach 119,000 tons by mid-decade. About 60,000 tons will be consumed by rosin sizing. If the expected second-quarter price hike holds, there will likely be no further boosts in 1983.

Mr. Shockett is consulting editor-chemical markets for PULP & PAPER.

PULP & PAPER

May 1983

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Hammermill's market pulp expansion at Selma, Ala.

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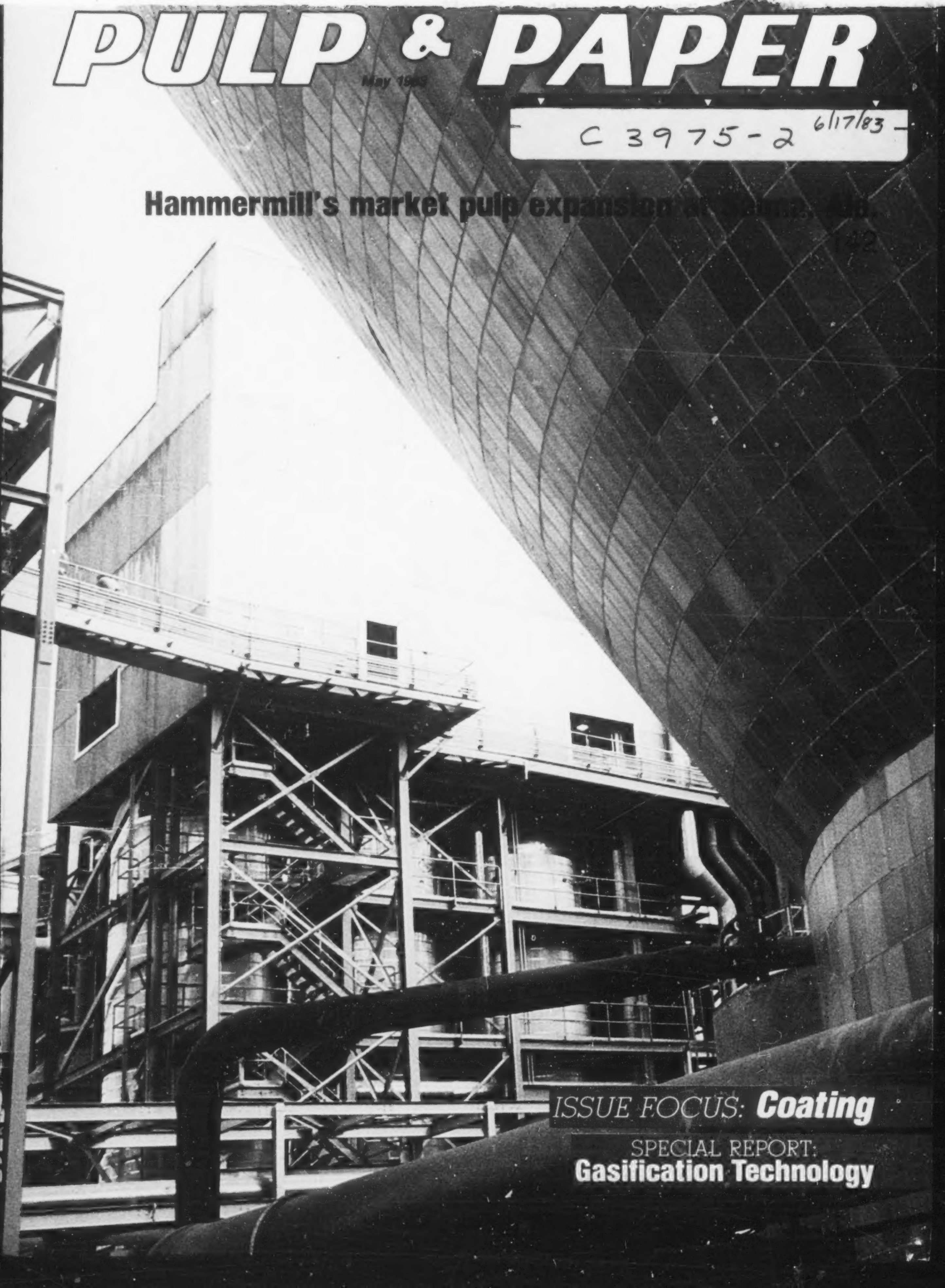

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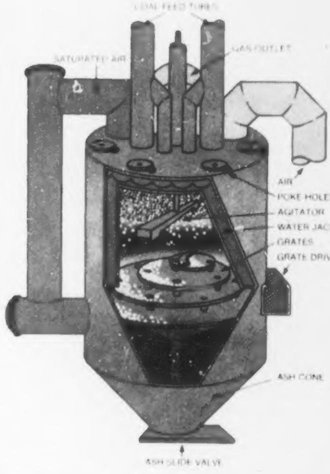

COAL GASIFICATION **118**

***COVER:** Hammermill's recent expansions at Selma, Ala., include new high-density storage and batch digester capacity. Story begins on page 142. (Photo courtesy of Martin Public Relations Associates and Simons-Eastern, which is celebrating its 25th anniversary this year--see page 210).*

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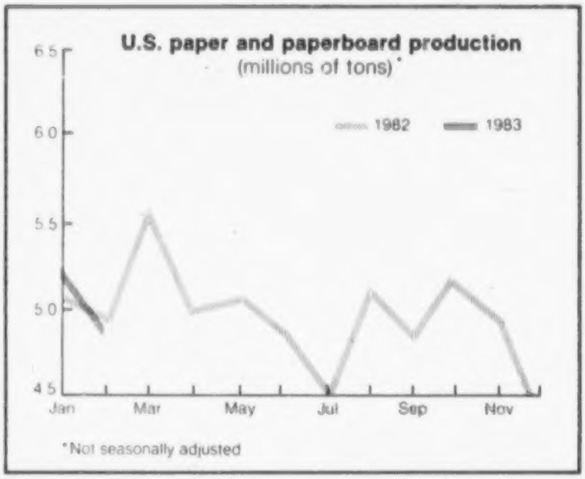
MONTH IN STATISTICS

U.S. paper and paperboard production in February totaled almost 4.9 million short tons, down 1% from February 1982 levels, according to the American Paper Institute. Adjusted for seasonal and workday factors, January-February production was at a rate of 62.6 million tpy, up 2.7% from the relatively high year-earlier rate, comparing favorably with the 62.3 million tons produced in the record-year 1981. Preliminary data for March indicate a flattening of the trend, with the adjusted annual rate holding at about 62 million tpy.

Among major grades, coated paper showed the largest gain, with production up 7.8% over last year. Also strong were uncoated free-sheet papers, up 4.2%, and tissue, up 7.5%. Except for semichemical medium, down slightly, paperboard grades were up 3% to 4% over February 1982. Output of kraft linerboard was sustained by relatively strong demand for exports.

Total Canadian newsprint shipments in February fell to 605,000 metric tons, down 11.5% from a year ago, according to the Canadian Pulp & Paper Assn. Newsprint mill operating rates were down to 85% from 95% last February. Woodpulp shipments totaled 490,000 metric tons, up 2.1% from year ago.


U.S. paper and paperboard production
(millions of tons)*

*Not seasonally adjusted

		Latest month (000 short tons)	% change from year ago	Annualized year-to-date (000 short tons)	% change from year ago
PAPER & PAPERBOARD PRODUCTION[1]					
Newsprint	February	417	0.2	5,166	−1.5
Uncoated groundwood (s)	February	109	—	1,349	1.9
Coated paper (s)	February	413	6.2	5,131	7.8
Uncoated free sheet (s)	February	628	−0.8	8,023	4.2
Unbleached kraft packaging and industrial (s)	February	307	−5.8	3,823	−0.3
Tissue	February	390	6.0	4,680	7.5
Total paper	**February**	**2,499**	**0.3**	**31,036**	**2.9**
Kraft linerboard, unbleached	February	1,104	−4.0	13,847	3.9
Semichemical medium	February	346	−2.5	4,367	−0.3
Bleached paperboard	February	306	1.0	3,787	3.2
Recycled paperboard	February	554	0.9	6,833	3.8
Total paperboard	**February**	**2,384**	**−2.4**	**29,766**	**2.4**
Total paper and paperboard*	**February**	**4,883**	**−1.0**	**60,801**	**2.7**
PULP, WASTEPAPER & FIBER[2]					
Total woodpulp production	January	4,247	4.6	50,969	4.5
Market pulp production	January	445	4.7	5,342	0.9
Wastepaper consumption at paper/board mills	January	1,177	−3.6	14,124	7.2
Pulpwood consumption (cords)	February	6,995	7.5	83,940	9.4
CONVERTED PRODUCTS STATISTICS[3]					
Corrugated box shipments (billion ft^2)	February	18.715	—	38.695†	3.2
Containerboard inventories at box plants	Feb. 1	2,486	−2.3		
INTERNATIONAL TRADE[2]					
U.S. paper imports (including products)	January	684	1.3	8,212	1.8
Imports of Canadian newsprint	January	540	−7.1	6,485†	−7.0
U.S. paper exports (including products)	January	349	12.9	4,189	13.1
Exports of unbleached kraft linerboard	February	155	−5.5	2,018	13.7
Exports of woodpulp	January	234	5.9	2,806	5.7
CANADIAN STATISTICS[4] (reported in metric tons)					
Total newsprint shipments	February	605	−13.1	1,209†	−11.5
Operating rates	February	84%	95%	82%	95%
Inventories held by U.S. consumers	Feb. 28	1,283	−21.4		
Woodpulp shipments (export only)	February	490	2.1	924†	−0.5
Operating rates	February	88%	91%	80%	86%

1. American Paper Institute. 2. API, Bureau of Census, American Pulpwood Assn. 3. Fiber Box Assn., Paperboard Packaging Council. 4. Canadian Pulp & Paper Assn.
*Includes construction and wet machine grades. †Not annualized. ‡Not directly comparable to year ago because of coding change. (s) = shipments.

Sale of CZ Canada now approved

British Columbia officials have approved the sale of Crown Zellerbach Canada Ltd. to Fletcher Challenge Ltd. of New Zealand. In the wake of earlier action by the federal Foreign Investment Review Agency and the Cabinet in Ottawa, the transaction was dependent only on the official signing ceremony in San Francisco.

In the $242-million deal, FC gets 84% of CZ Canada stock and is obligated to make an offering for publicly held shares (P&P, Feb., p. 27). The Canadian firm will apparently be operated as a separate subsidiary of FC, rather than being merged into FC subsidiary Tasman Pulp & Paper. CZ Canada president Thomas Rust said management was told it will stay on the job.

A stipulation in the agreement obligates FC to offer some of CZ Canada's stock to the public within seven years, Rust noted. The company would not say how much stock would be offered—but one security analyst estimated 40% to 49%.

Within the next year, a new name for the Vancouver, B.C.-based company must be found. The name cannot include any reference to the word "Zellerbach," a spokesman said, but those restrictions do not apply to the word "Crown."

CAPITAL SPENDING

Paper industry to boost '83 spending

U.S. pulp and paper companies are planning an ambitious increase in capital spending this year despite depressed profits, weak balance sheets, and relatively low operating rates for most grades. The latest Commerce Dept. survey conducted in January and February shows paper companies lifting outlays for new plant and equipment by 2.0% in 1983 to $6.09 billion, while the latest McGraw-Hill survey shows the industry boosting expenditures by 7.2% to $6.4 billion. This is up from actual spending of $5.97 billion last year which was 12.2% below the all-time peak of $6.80 billion reached in 1980.

Capital spending plans of major U.S. pulp and paper companies for 1983 (millions of $)

Company	1983	1982	% change 1983/82
Boise Cascade	$150	$151	—
Crown Zellerbach	280	305	− 8.1
Federal Paper*	33	67	−51.1
Fort Howard	65	40	+62.5
GN Nekoosa	385	275	+40.0
Hammermill	70	170	−58.8
International Paper	760	469	+62.0
ITT Rayonier*	70	78	− 9.7
Kimberly-Clark	400	291	+37.5
Mead	127	137	− 7.3
St. Regis	142	286	−50.3
Southwest Forest	18	30	−41.9
Union Camp*	317	162	+95.7
Westvaco*	180	170	+ 5.9

*Preliminary data from P&P capital spending survey conducted in late 1982. Other statistics are from 1983 annual reports and recent company announcements.

This compares with a 1.7% decline in capital spending by all U.S. business in 1983, following a 1.6% decline in 1982—the first such back-to-back decline in postwar history, according to the Commerce Dept. Inflation for capital goods in 1983 is estimated at only 1.7%, indicating a real decline in spending for all U.S. business of 3.8% and relatively flat spending for the paper industry.

Spending is expected to reach a low of $5.74 billion in the first quarter, then rise to $5.74 billion in the second and average $6.51 billion, according to the Commerce Dept. data. If the economy begins to improve, a number of companies have indicated they might begin to scale up their "bare-bone" spending plans for 1983. Already Champion International decided to resume production on its $500-million hardwood market pulp mill for Michigan's Upper Peninsula (see p. 27).

Rush to get financing. A review of individual company spending plans shows that several companies with major mill projects under way—such as International Paper Co., Union Camp Corp., and Great Northern Nekoosa Corp.—plan sizable increases in capital spending this year. On average, the 14 companies shown in the accompanying table plan to boost outlays by 13.0%.

To finance their ambitious capital programs, paper companies have been turning heavily to external financing, either in the form of equity or longer-term debt to take advantage of surging stock prices and declining interest rates (see table). "Recent and prospective activity in financial markets is extensive, both to repair balance-sheet deterioration and to strengthen working capital and extend capital programs," notes analyst Bruce Kirk of Goldman Sachs.

Machinery orders. Because of weakness in 1982 order rates, shipments of U.S. paper machinery are expected to be relatively flat compared with last year's estimated level of $1.37 billion, according to Commerce Dept. New orders for paper machinery this year, however, should be up about 15%.

Exports of U.S. paper machinery in 1983 should jump 7% from their 1982 level of $316 million, which was down from a 1981 peak of $351 million, according to the department's new *1983 U.S. Industrial Outlook*. Imports should be stronger and surge 20% from their 1982 level of $225 million, which was down sharply from a 1981 peak of $273 million.

External financing by U.S. paper companies in 1983

Equity	Value (millions of $)	Type of issue	Approximate date
Boise Cascade	$100	Conv. PS	1/83
James River	75	Common stock	1/83
GN Nekoosa	40	Conv. PS	2/83
Stone Container	36	Common stock	3/83
Weyerhaeuser	135*	Common stock	planned
Debt			
Georgia-Pacific	100	SF debentures	2/83
Kimberly-Clark	100	SF debentures	2/83
Southwest Forest	40	CS debentures	3/83
Westvaco	75	Debt (unspecified)	planned

*Estimated value based on current stock price. CS: convertible subordinated. PS: preferred stock. SF: sinking fund.

NEWS ROUNDUP

LABOR

Strikes settled at two IP mills

Striking members of the United Paperworkers International Union returned to work at International Paper Co.'s Vicksburg, Miss., mill on Mar. 22 after ratifying a new three-year agreement. Five days later, striking UPIU members at the company's Pineville, La., linerboard mill agreed to a three-year contract and also returned to work.

The contracts at both Vicksburg and Pineville call for wage increases of 7% the first year and 6% in each of the last two years. The pay figures are the same as rejected by the union at both mills prior to the Feb. 1 walkouts (P&P, Apr., p. 29). At the time, however, the company refused to make the increases retroactive to the Sept. 27, 1982 expiration date of the contract. In the new agreements, the company has agreed to a Nov. 1 retroactivity date, said an observer close to the negotiations.

- Striking members of the United Paperworkers International Union returned to work at **Simpson Paper Co.**'s 135-tpd fine papers mill in Miquon, Pa., on Mar. 7, after approving a new three-year labor contract a day earlier.

The new agreement, which expires Feb. 15, 1986, calls for wage increases of 7% the first year and 6% in each of the last two years. A dental plan was added in the second and third years and other benefits were improved, a union spokesman said. The strike began on Feb. 15 (P&P, Apr., p. 29).

- **Federal Paper Board Co.**'s folding carton converting plant in York, Pa., has been on strike since Mar. 5, when UPIU workers walked off the job after voting down an offer of 25¢/5%/6% in a three-year agreement.
- At a February meeting, the UPIU increased strike benefits $10 to $55/week retroactive to January, according to a union newspaper. Officials said the move was intended "to show support for members facing concession demands at the bargaining table and difficult economic conditions which limit their options."

B.C. labor talks set for Apr. 29

Negotiations involving most of British Columbia's forest products industry were scheduled to begin on Apr. 29, a date set by the United Paperworkers International Union to present its demands to the Pulp & Paper Industrial Relations Bureau, bargaining agent for most pulp and paper companies in the province.

The wood products industry's agent, the Forest Industrial Relations Ltd., has not set a date to meet with the International Woodworkers of America negotiators, although IWA contracts expire on June 15, two weeks earlier than UPIU and Pulp & Paper Workers of Canada contracts expire.

The IWA, however, has drafted its goals. It is seeking a one-year contract with a "substantial" wage increase, as well as better job security and a cost-of-living clause, observers said. UPIU and PPWC will both be meeting separately the week of Apr. 18 to formulate their agendas. Unlike UPIU, however, PPWC has not set a date to meet with the PPIRB.

The forest products industry has taken the stand that it cannot afford to increase any costs in 1983, including wages, said a spokesman of the FIR and PPIRB. The agencies will be seeking a three-year agreement with no pay hike in the first year and "gradual improvements" in the second and third years, he noted.

"The industry is saying that in order to get back on its feet, to restore economic health, and provide the kind of stability that will keep people working, it needs a minimum three-year recovery period," he said.

EMPLOYMENT

Industry wages rose over 7% in 1982

Average hourly earnings of production workers in U.S. pulp and paper mills in December 1982 were 7.9% higher than in December 1981, but had dropped 0.9% from the September 1982 level, according to Bureau of Labor Statistics data. Weekly hours for December were 0.2% higher than a year earlier and unchanged from the September level. Overtime hours were the same in December for both years, but were 18.6% lower in December than in September 1982.

Production workers at paperboard container and box plants were earning 7.9% more per hour in December 1982 than in 1981, and 1.2% more in December than in September 1982. Weekly earnings were up 6.9% in the year-to-year period, and up 1.7% in December over September 1982.

Weekly hours dropped 1.0% in the year and rose 0.5% in the three months ending December 1982. Overtime hours worked were the same in December for both years, but dropped 11.8% in December vs September 1982.

Production worker employment in the paper and allied products industry was 483,200 in December 1982—a 4.5% decline from December 1981. Preliminary January 1983 data from BLS indicate a further 0.8% drop to 479,300 employees. The unemployment rate in the paper and allied products industry in January 1983 was 8.2% (61,000 unemployed), compared with 8.0% in 1982 (59,000 unemployed).

Average earnings and hours of production workers in the paper and allied products industry

	Dec. 1982	Sept. 1982	% change for quarter	Dec. 1981	% change year ago
Paper & allied (SIC 26)					
Hourly earnings	$9.65	$9.63	0.2%	$8.96	7.7%
Weekly hours	42.4	41.7	1.7	42.7	−0.7
Overtime hours	4.1	4.6	−10.9	4.2	−2.4
Weekly earnings	409.16	401.57	1.9	382.59	6.9
Pulp & paper mills*					
Hourly earnings	$11.28	$11.38	−0.9%	$10.46	7.9%
Weekly hours	44.5	44.5	—	44.4	0.2
Overtime hours	5.7	7.0	−18.6	5.7	—
Weekly earnings	501.96	506.41	−0.9	464.42	9.0
Paperboard containers & boxes					
Hourly earnings	$8.46	$8.36	1.2%	$7.84	7.9%
Weekly hours	40.9	40.7	0.5	41.3	−1.0
Overtime hours	3.6	3.4	−11.8	3.0	—
Weekly earnings	346.01	340.25	1.7	323.79	6.9

*Does not include figures for paperboard mills, which are similar.
Source: Dept. of Labor, Bureau of Labor Statistics

Coated groundwood papers: Demand improving, but market still glutted

Statistics	**1981**	**1982**	**1983e**
Production, 000 tons[1]	2,804	2,890	3,050
Capacity, 000 tons[2]	3,047	3,312	3,625
Utilization rates, %	92.0	87.3	84.1
Imports, 000 tons	35	70	55
Exports, 000 tons	46	36	41
Apparent U.S. consumption			
000 tons	2,620	2,924	3,064
lb/capita	23.54	25.24	24.63
000 tons/$ billion real GNP (1972)	1.77	1.93	2.07

e = estimated

[1] Pulp & Paper estimates

[2] API capacity for coated groundwood papers; includes coated grades No. 5 and some of No. 4

Grade structure: Coated groundwood publication paper consists of furnish having at least 10% mechanical pulp, with the rest consisting of chemical pulp. It includes mostly No. 5 paper, with some No. 4 paper, both of which are coated on two sides. No. 5 paper has lower basis weight than No. 4, while No. 4 is of higher quality and brightness than No. 5. Basis weights usually range from 32 lb to 70 lb (25 × 38 in — 500). End-uses include offset, rotogravure and letterpress printing. In the case of lightweight coated (LWC) paper, coat weight can represent up to 30% of total sheet weight.

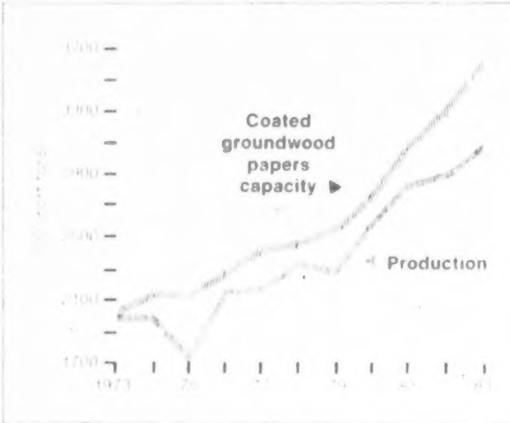
Production/capacity: Production growth of about 3% in 1982 slowed considerably from advances in previous years, according to Pulp & Paper estimates (American Paper Institute does not release production figures for coated groundwood). During the same period, three new machines came online, adding 543,000 tpy of capacity. This follows a rise of 11.5% in capacity in 1981. Between 1981 and 1986, capacity is expected to expand 33%, according to API figures.

Outlook: Markets for coated groundwood papers are expected to improve slightly in 1983, as advertising picks up in magazines in response to a parallel growth in the economy. Catalog and direct mail users will also be increasing their consumption in line with improvements in consumer spending.

The market should also gain from increased use of coated groundwood for newspaper inserts and other advertising pieces. Despite a hefty 13% advance in the market early this year, though, average annual growth rates for 1983 are expected to be in the area of just 5% to 7%, observers say. Operating rates should also remain depressed at about 89%.

Prices: Prices stagnated in 1982 and actual transaction quotes began eroding early in 1983. Some observers expected that increases might be put through later in the year, depending on the speed with which the market strengthens. Typical pricing trends ($/short ton) are, for 34-lb paper: 1973, 285; 1974, 400; 1975, 385; 1976, 460; 1977, 500; 1978, 570; 1979, 637; 1980, 673; 1981, 735; 1982, 760; 1983, 760.

Markets: About 64% of No. 5 goes into magazines, with commercial printing taking another 22%, and catalogs accounting for 17%.



Estimated 1983 capacities of major U.S. companies are:

	Annual capacity (000 tons)	Capacity share (%)
1. St. Regis Paper Co.	543	15.0
2. International Paper Co.	450	12.4
3. Consolidated Papers Inc.	411	11.3
4. Crown Zellerbach Corp.	280	7.7
5. Boise Cascade Corp.	270	7.4
6. Blandin Paper Corp.	257	7.1
7. Mead Corp.	230	6.3
8. Midtec Paper Co.	223	6.1
9. Weyerhaeuser Corp.	175	4.8
10. Pentair Industries Inc.	175	4.8
11. Fraser Paper Ltd.	160	4.4
12. Bowater Inc. (Bowater Carolina)	125	3.4

U.S. No. 5 capacity (1983): **3.625 million tons**
Capacity share of top five companies: 53.9%
Capacity share of top ten companies: 83.1%

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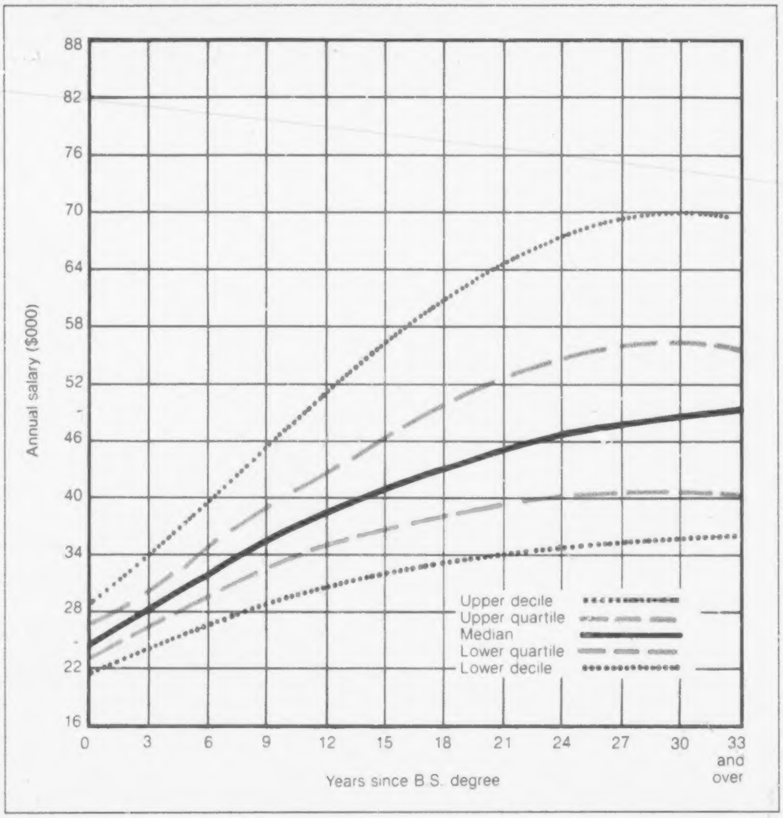
FIGURE 1: **Annual salary of engineers in the paper and wood products industries since B.S. degree, 1982**



Paper industry engineers'

By SYBILLA A. SUDA, Staff Editor

TABLE 1: **Engineers' median salaries by group**

Industry	**1982 salary**	**1981 salary**	**% change**
Petroleum	$41,850	39,200	6.8%
R&D	39,100	36,050	8.5
Chemicals	38,750	35,400	9.5
Mining	37,300	n.a.	n.a.
Paper	**36,100**	**32,800**	**10.1**
Electronic equipment	34,600	n.a.	n.a.
Mechanical equipment	34,600	31,400	10.2
Aerospace	33,900	31,550	7.5
Design, consulting & engineering	33,750	29,300	15.2
Local government	33,150	28,150	17.8
Metals	31,600	28,900	9.3
Electrical equipment	31,300	n.a.	n.a.
Construction	30,700	n.a.	n.a.
Federal government	30,000	31,600	−5.1
State government	28,150	26,700	5.4
Average	**34,320**	**31,880**	**7.7**

Source: Engineering Manpower Commission.

Complete salary data are published in *Professional Income of Engineers—1982*, which can be purchased for $35 from the Engineering Manpower Commission of American Assn. of Engineering Societies, 345 East 47th St., New York, N.Y. 10017.

☐ Engineers in the paper industry were paid a median salary of $36,100 in 1982, up a hefty 10.1% over 1981 salaries and well above the 7.7% rise in the consumer price index from February 1981 to February 1982. Paper industry engineers were paid more than the average for 15 major industry groups—an estimated $34,320, according to the Engineering Manpower Commission of the American Assn. of Engineering Societies.

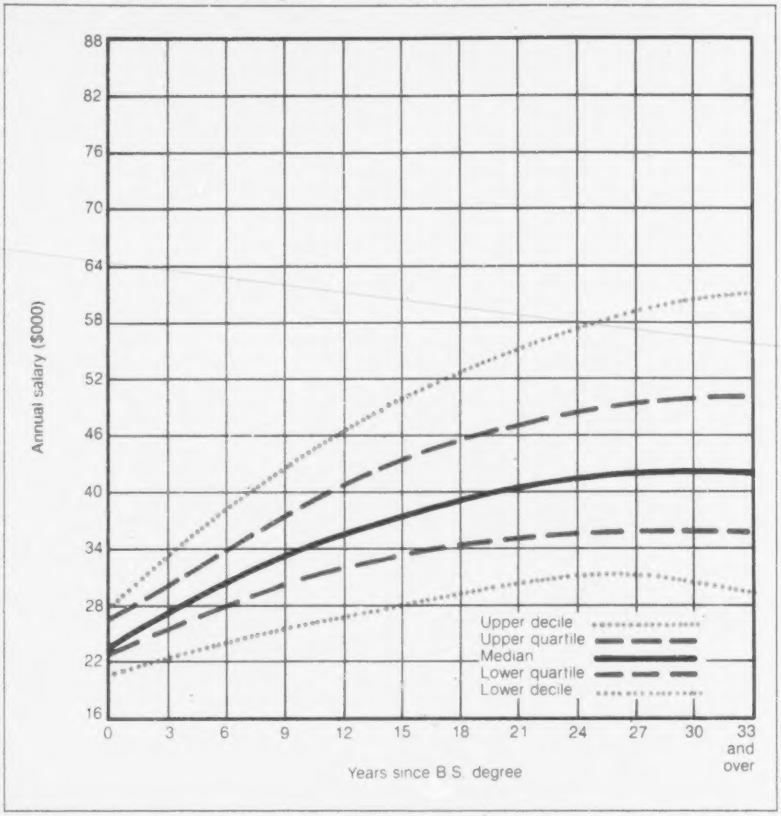
The commission's report, which is published on a yearly basis, surveyed companies, agencies, and other establishments representing over 135,000 engineers. Results of the survey are based on data gathered between February and May 1982.

Salary figures refer to base salaries before deductions and allowances, including a cost-of-living differential, if any. Not included are unpredictable payments for overtime work, stock options, and the like.

Paper industry engineers ranked fifth in median salaries paid in 1982, exceeding their 1981 ranking position (see Table 1). The 10.1% rise in salaries of paper industry engineers was one of the higher increases among industries, and was well above the average salary increase of 7.7%.

Compared with the 1981 survey conducted by the commission, the current survey shows salaries of newly employed engineers in the paper industry rose about 15.2% in 1982 over 1981, to a median starting salary of

FIGURE 2: **Annual salary of engineers in all industries since B.S. degree, 1982**



salaries in 1982 up 10% from 1981

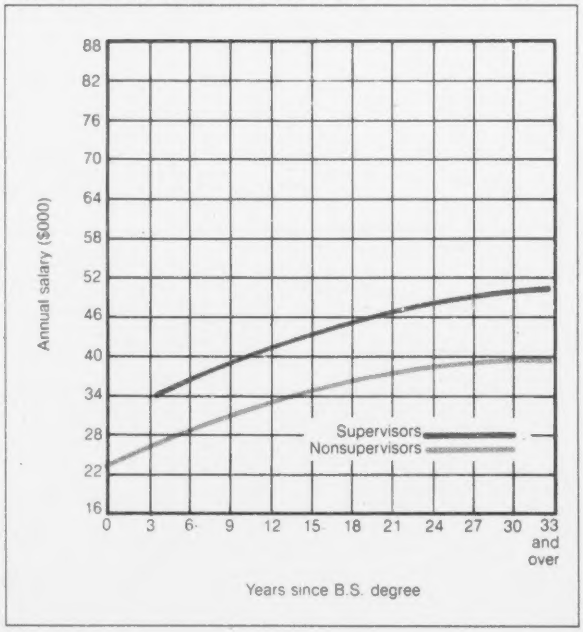
$25,000 and a high of $28,100. This range encompasses an actual decline for engineers working for the federal government, who ranked seventh in the previous survey, to the 15.2% rise for those in design, consulting and engineering, who ranked eleventh in the 1981 survey.

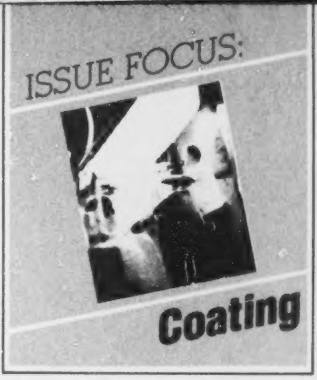
Salaries of all types of engineers in the paper industry are shown in Figure 1, which plots annual salary against the number of years after receiving a bachelor of science degree. For comparison, annual salaries of all industry engineers are plotted in Figure 2. Salaries of experienced engineers in the paper industry are up nearly 8% over 1980, according to the survey.

On a regional basis, salaries of all engineers in the west-south-central and Pacific regions were highest, followed by those in the mid-Atlantic and (east) north-central regions of the country.

Differences in salary exist for many reasons other than years of experience, and these factors must also be taken into account when comparing salaries. For example, data on all engineering categories show that engineers in supervisory positions earned considerably more than those who were in nonsupervisory positions. In the paper industry, salaries paid to all supervisory engineers average out to $46,400, up 12.5% over 1981, while salaries paid to nonsupervisory engineers average out to $30,100, down 1.3%, according to the survey (see Figure 3). ☐

FIGURE 3: **Median salaries of supervisory vs nonsupervisory engineers in the paper and wood products industries, 1982**





Coating, filler pigments: prices competitive, discounts common

P & P's annual survey reports pigments are generally available; demand has remained good. Overcapacity, competitive pricing remain in many grades

PULP & PAPER STAFF REPORT

☐ PULP & PAPER's exclusive annual survey of the availability and prices of paper coating and filler pigments found producers in the midst of what is generally viewed as a "holding pattern." Although paper industry use held up surprisingly well in 1982 and most expect 1983 to be a similar and better year in terms of paper industry demand, overall demand and profits are down. Other nonpaper sectors had an off-year in 1982, and in general pricing has remained weak, which has continued to place many producers in a price/cost squeeze. In particular, the severely depressed housing and steel industries have significantly affected overall consumption of many pigments, including titanium dioxide, kaolin, etc.

The roughly 1.0 million housing starts in 1982, depressed auto sales, and overall weak steel markets resulted in reduced demand for pigments in paint and coverings, and for refractory clays. Data from the U.S. Bureau of Mines show that an estimated 6.33 million short tons of kaolin were produced in 1982 vs 7.983 million short tons in 1981—the lowest overall level since 1977. Georgia increased its share of this smaller market to about 84% of total U.S. kaolin production. Exports also eased, reflecting the depressed world economy. This drop in demand, combined with the expansions completed in 1980-82, lowered operating rates to the 60% range.

Kaolin producers who are mainly integrated into paper industry product lines fared much better in general than overall production data indicated. The major paper industry consumers of kaolin, coated paper, and uncoated printing/writing papers performed better than the industry as a whole. Coated paper shipments rose a modest 1.8% in 1982 to 5.03 million short tons, vs 4.94 million short tons in 1981. Uncoated free-sheet grades did not do quite as well, but production remained basically static at 7.86 million short tons, a 0.4% drop from 7.89 million tons in 1981. Coated boxboard and other grades consuming coating and filler pigments generally showed a drop in 1982 production. Demand for these pigments in 1983 is forecast to be up a modest 5%, with printing/writing papers expected to perform better as business activity improves.

Kaolin clay

Kaolin clay on a tonnage basis is by far the major pigment used by the paper industry in coating and filler applications. Overall industry demand held up well in 1982, and preliminary estimates are that a total of about 3.4 million short tons were used domestically in coating and filler end-uses. Most producers indicated that their 1982 shipments were on par with 1981 levels, with at least one indicating that shipments were up about 8% last year.

As reported in last year's survey (P&P, May 1982, pp. 119-121), the combination of uncertainty concerning the performance of the economy, steady demand combined with expanded capacity, and relatively weak paper prices resulted in an intensely competitive pricing situation. Many producers reported that list prices were basically meaningless, discounting prevalent, and transaction prices were in some cases at 1980 levels.

The situation as reported this year is largely unchanged, although a variety of list prices were reported. One producer noted that list prices up and down his product line were unchanged and that actual transaction prices are very similar to last year. Other producers raised list prices incrementally (2% to 5%), but actual prices mills pay are very close to last year's levels.

Generally, the outlook for kaolin prices in 1983 is very conservative. As one producer noted, "List prices will be difficult to raise and any actual increases that occur will merely reflect the elimination of the current substantial discounting." Most producers who felt relatively optimistic about 1983 forecast somewhat moderate increases in the 5% to 8% range.

However, there were some producers who felt that no increases are likely, especially in light of the fact that the current excess in coated paper capacity will keep operating rates depressed and pricing weak for these paper grades. Increases will be difficult to pass on to the mills until their balance sheets improve. The recent drop in energy prices will aid both kaolin producers and mills in increasing or at least sustaining their margins.

Anhydrous kaolin prices reportedly rose 5.8% to $365/ton following an 11.3% increase in 1982. High-brightness No. 1 grades increased generally in the 6% range although, as mentioned, not all producers raised lists, and actual transaction prices vary.

All grades of kaolin, including premium pigments (anhydrous, high-brightness No. 1, delaminated grades); commodity coating clays (such as Nos. 1 and 2 clays); and filler clays (both water-washed and air-floated); are reported to be readily available. The tightness in certain premium and filler clays reported a few years ago has disappeared following the round of expansion projects most producers have completed.

Several producers have installed spray dryers and magnetic separators to alleviate the shortages that recently occurred in these grades. Calcined clay facilities are being expanded also (e.g., J.M. Huber Corp.) to supply calcined extender pigments to replace titanium dioxide. The current excess capacity situation seems to ensure that kaolin supplies in particular will be adequate in the forseeable future.

Titanium dioxide

Producers report both rutile and anatase grades are generally in good supply, reflecting continual weakness in protective coatings markets such as paint for houses and autos. Recently the stronger performance of the paper industry, relative to other titanium dioxide end-use markets, has shifted paper's market share slightly up from the low-20s to the mid-20s. This is the second-largest outlet for this pigment, after the roughly 42% to 44% market held by paints, varnishes, and lacquers.

Most producers believe that prices have stabilized at their current discounted price levels, and demand is expected to improve in 1983 as auto and housing markets rebound. There are reports that actual transaction prices for anatase are as low as $0.61/lb and $0.66 for rutile.

Inventories are reported to be low, ensuring that a pickup in demand will materialize as an increase in production and firming in price. Low titanium dioxide industry operating rates continue to plague producers, with only about 60% to 65% of capacity being utilized. Some producers noted that imports have recently affected domestic producers and contributed to the aggressive pricing and supply/demand imbalance. This is due to excess capacity in Europe and the strong U.S. dollar. List prices for anatase grades is $0.69/lb, with some producers offering slurry and dry product at this price and others placing a $0.01/lb premium on dry pigment. Rutile lists were reported to be $0.75/lb.

Calcium carbonate

Calcium carbonate ($CaCO_3$) demand by the paper industry was similar to 1981, most sources noted Both ground grades and precipitated calcium carbonate are reported in good supply. One supplier noted that paper industry demand for finer particle ground calcium carbonate continued to increase due to the surge in lightweight coated capacity.

Overall business did not perform as well, as paint markets continued to be depressed. Housing starts in 1982 were at the 1.0-million-unit level, but most producers felt that an improved economy in 1983 would raise starts to 1.5 million units. The outlook for $CaCO_3$ in filler applications appears promising, with some large paper machines that have recently come onstream reportedly running alkaline systems.

Plastic and inorganic pigments

Plastic pigments used by the paper industry are reported to be in good supply, and prices have not increased since last year, remaining at $0.75/lb.

The price of urea formaldehyde pigments rose 8.7% since last year's survey to $1.15/lb for paper industry grades. The price of silica-silicates pigments rose an average of 7.8%. PPG Industries will discontinue producing its Hi-Sil 404 extender pigment in September. ☐

TABLE 1: **Prices and availability of commonly used pigments for coating and filler applications**

	Availability[1]		**Price quotations ($)**[2]		**Year-to-year**
	1982	**1983**	**March '82**	**March '83**	**Increase** (%)
Calcium carbonate					
Ground natural, medium, ton dry	Market	Market	91-110[3]	98-125	10.9
Precipitated, bag, ton[4]	Market	Market to tight	44-200	155-218	8.4
Hydrated alumina, slurry, ton	Market	Market	365	365	0
Kaolin, clay, ton[5]					
Anhydrous kaolin	Market	Market	345	365	5.8
High brightness, No. 1	Market	Market	133-144	144-154	7.6
Delaminated, standard grades	Market	Market	88-115	96-134	13.3
No. 1 coating	Market	Market	84-106	88-107	2.6
No. 2 coating	Market	Market	66-86	70-84	1.3
No. 3 coating	Market	Market	64-77	68-81	5.7
Filler,					
Water-washed	Market	Market	51-62	51-66	3.5
Air-floated	Market	Market	30-40	31-40	1.4
Plastic pigments, lb	Market	Market	0.75	0.75	0
Satin white, 100 lb, drum 37% solids	Market	Market	12.00	12.00	0
Silica-silicates, ton	Market	Market	520-535[6]	530-620	9
Talc, bag, ton	Market	Market	158-174	169-189	7.8
Titanium dioxide					
Anatase, lb, dry	Market	Market	0.69-0.73	0.69-0.73	0
Anatase, lb, slurry	Market	Market	0.60-0.70	0.69-0.70	0
Rutile, lb, dry	Market	Market	0.75-0.80	0.75-0.77	0
Urea-formaldehyde, lb	Market	Market	1.15[7]	1.25	8.7
Zinc oxide, lb	Market	Market	0.5275-0.5475[8]	0.5025	−6.5

1. Availability terms are defined as follows: Very tight—on allocation or demand significantly higher than supply; Tight—demand slightly greater than supply; Market—supply and demand in balance or excess capacity available.
2. Prices are based on quotations for bulk f.o.b. plant shipments, except where noted, but do not necessarily represent the range in prices listed by all producers.
3. Higher-quality ultrafine and fine-ground calcium carbonate grades are available at $20-$40/ton more than the highest price.
4. Bulk shipments are $32-$45/ton lower.
5. Slurry shipments of kaolin clays are $6/ton lower on a dry basis. Shipment in 50-lb bags usually commands a premium of $20-$22 over bulk prices.
6. Silica-silicates having lower brightness and larger average particle size are available for $20-$35/ton less than the quoted prices.
7. Urea formaldehyde pigment having finer average particle size is available at $0.40/lb more than the quoted price.
8. Price per lb truckload quantities, add 0.05 less than truckload quantities.

Wastewood gasification economical

Cost of refitting an oil/natural gas-fired boiler for hog fuel/wastewood burning makes user gas produced at the mill an economically attractive option

By RICHARD W. HELM

□ The economic feasibility of a proposed wood gasification facility rests primarily on the cost and quality of available wood feedstock, financial parameters, and the cost of conventional fuels. Other important factors include type of gasifier selected, the degree of sophistication incorporated into the gasification plant, size of the proposed plant, type of end-user application considered, and local environmental regulations. A site- and application-specific study is, therefore, recommended to accurately evaluate the economics of a proposed wood gasification facility.

Types of gasifiers

Two basic types of wood gasifiers are currently available: the fixed bed and the fluidized bed. The fixed bed, is available in three different versions: updraft, downdraft, and cross draft.

A brief list of gasifier developers and manufacturers for fixed and fluidized gasifiers is shown in Table 1.

A typical fluidized bed gasifier is shown in Figure 1. Fluidized beds usually contain an inert material (such as sand) along with wood char and ash which are held in suspension (simulating a "fluid") by a rising column of gas. The solids are subjected to rapid agitation and mixing, resulting in high heat and mass transfer throughout the bed. As a result, the wood residence time is comparably shorter for a fluidized bed than for a fixed bed. Single fluidized bed units can be built in the 80- to 100-million Btu/hour range because of the relatively high throughput.

Both fluidized bed and fixed bed wood gasifiers operate at pressures slightly above atmospheric pressure, usually in the 1- to 5-psi range.

Gasification feedstocks

Large quantities of logging and mill residues are available in the U.S. Logging residue is generated primarily as a result of timber harvesting. Mill residue is generated mainly from barking and wood product processing. Currently, the time and expense for collection, transportation, and processing of logging residue for use as a gasifier feedstock may be prohibitively high due to the scattered distribution and remote location from potential users.

Mill residues occur in a large variety of forms (slabs, edging, sawdust, planer shavings, sander dust, ends, veneer and plywood trimmings, cores, defective products, etc.). Current uses for mill residues are dominated by the use of the coarse wood fraction for pulp manufacture. An additional fraction of the wood residue is used for raising process steam and/or electric power generation.

Mill residue is often further processed to reduce its size for easy handling. The reduced size mill residue is often called hog fuel.

The type of wood feedstock available for a proposed gasification application will have a direct impact on the type of gasifier selected (fluidized bed or fixed bed). Hog fuels with a wide size distribution from woodchips to sawdust are best suited for fluidized beds. A biomass densification process producing briquets or pellets from a sawdust feedstock can be considered to prepare a suitable feedstock for a fixed bed gasifier.

TABLE 1: **Wood gasifier developers and manufacturers**

Fixed bed
Updraft (countercurrent)
  Applied Engineering Co., Orangeburg, S.C.
  Halcyon Associates Inc., East Andover, N.H.
Downdraft (co-current)
  Biomas Corp., Yuba City, Calif.
  Duvant Co., Valenciennes, France
  Imbert Energie Technik, GmbH, Weilerswist, W. Germany
  Pillard Co., Marseille, France

Fluidized bed
Alberta Industrial Dev., Edmonton, Alta.
B.C. Research, Vancouver, B.C.
Energy Products of Idaho (EPI), Coeur d'Alene, Idaho
Energy Resources Co. (ERCO), Cambridge, Mass.
Omnifuel Gasification Systems Ltd., Toronto, Ont.
Weyerhaeuser Co., Tacoma, Wash.

Mr. Helm is senior process engineer, Gilbert/Commonwealth Inc., Reading, Pa.

alternative to burning solid wood

The moisture content of the available wood feedstock will have a direct effect on the gasifier thermal efficiency and product gas heating value. Fluidized bed gasifiers can handle wood feedstocks with moisture contents in excess of 50%, but the product gas heat duty (gas heating value plus sensible heat) will be less than 100 Btu/scf. Seasoned wood feedstocks with a moisture content of 30% by weight or less are preferred for both fluidized bed and fixed bed gasifiers. A front-end wood drying unit should be considered if the available wood moisture content is too high.

The cost of wood feedstocks for a planned gasification facility will depend on the location of the plant site and the availability of wood feedstocks in that general vicinity. Assuming an abundant supply of wood residues or hog wood in the general plant vicinity, the cost of hog fuels will most likely range from about $7 to $25/ton (b.d.).

Wood vs coal properties

Gasification of coal has received considerable attention by government and industry in the U.S. since the early 1970s. Some of the positive and negative character-

FIGURE 1: **Schematic diagram of a fluidized bed gasifier**

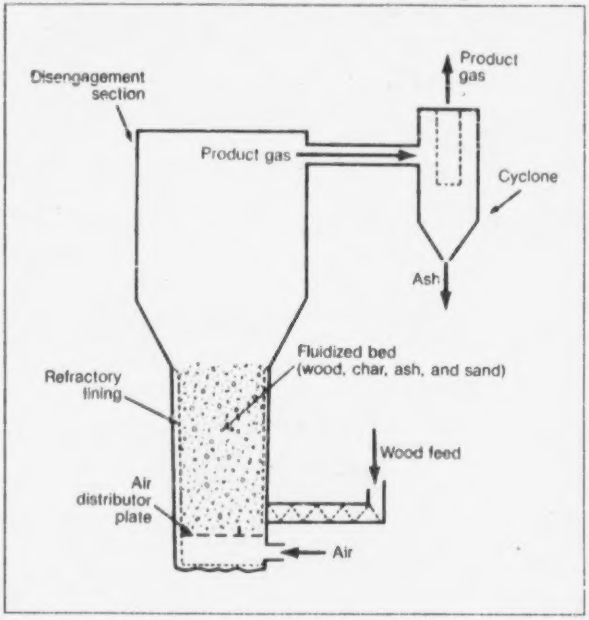

Product gas
Disengagement section
Product gas
Cyclone
Ash
Fluidized bed (wood, char, ash, and sand)
Refractory lining
Wood feed
Air distributor plate
Air

FIGURE 2: **Rotary kiln schematic diagram**

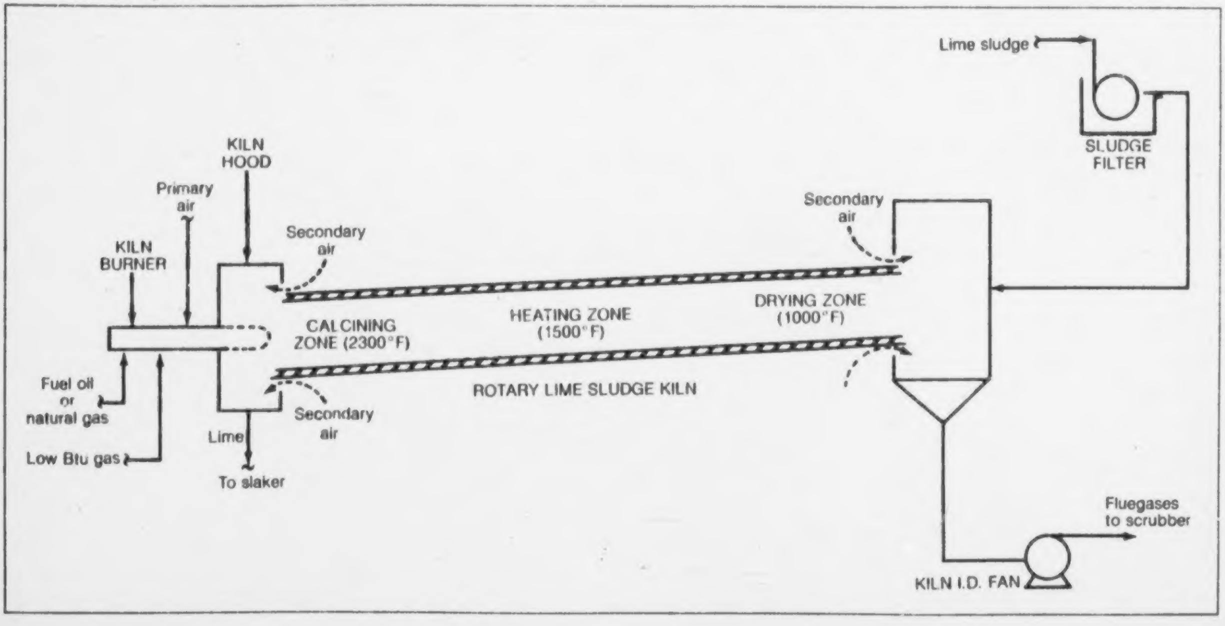

Lime sludge
SLUDGE FILTER
KILN HOOD
Primary air
KILN BURNER
Secondary air
Secondary air
CALCINING ZONE (2300°F)
HEATING ZONE (1500°F)
DRYING ZONE (1000°F)
ROTARY LIME SLUDGE KILN
Fuel oil or natural gas
Low Btu gas
Lime
To slaker
Secondary air
Fluegases to scrubber
KILN I.D. FAN

TABLE 2: **Woodfuel characteristics compared to coal**

Positive woodfuel characteristics relative to coal
High volatile content
Low ash content
Low sulfur content

Negative woodfuel characteristics relative to coal
High moisture content
Low bulk density
Irregular size distribution

TABLE 3: **Comparison of fuel combustion characteristics**

Analysis (%)[1]	**Natural gas**	**No. 6 fuel oil**	**Low-Btu[2] wood gas**
C	—	85.5	—
CO	—	—	19.3
H_2	—	11.5	19.0
CH_4	99.0	—	—
C_2H_6	0.2	—	—
CO_2	0.2	—	9.5
N_2	0.6	—	40.8
S	—	3.0	—
H_2O	—	—	11.4
Total	**100.0**	**100.0**	**100.0**
Volume ratios			
Combustion air/fuel, input, scf/scf, scf/lb)	9.47(222.4)	(181.6)	0.91(14.7)
Fuel-air mix/fuel input HHV, scf/million Btu	10,406	—	12,417
Fluegas/fuel input HHV, scf/million Btu	10,482	10,427	11,150
HHV			
Btu/scf fuel gas	1,006(23,624)	(18,470)	154(2,497)[3]
Btu/scf air-fuel mix	96.1	—	80.5
Btu/scf fluegas	95.4	95.9	89.7

1 Volume (%) for fuel gas and natural gas; weight (%) for oil
2. Hot low-Btu gas from fluidized bed wood gasifier, 20% moisture content wood, gas temperature is 1,500°F
3. Includes sensible heat to 1,500°F

istics of woodfuel as compared to coal (which affect gasifier selection) are summarized in Table 2.

Wood is easier to gasify than coal because (1) it has a much higher volatile content (typically 70% to 90%) and (2) it contains its own water—two elements important in forming gaseous molecules from high-carbon feedstocks.

With a few exceptions, biomass has less than 2% ash (while coal is typically 5% to 20%), and the typical biomass sulfur content is less than 0.1% (compared with 1% to 4% in coal). Biomass materials have carbon contents considerably lower than coals, and the hydrogen/carbon ratio is typically 1.5; for coal it is close to 0.80.

These advantages of wood for gasification are offset in part by a high moisture content, low bulk density, and irregular size distribution. These properties require a gasifier with a high degree of fuel flexibility or up-front preparation such as drying, sizing, or biomass densification.

The lower bulk density, irregular size distribution, and lower heating value (Btu/lb basis) substantially reduce the throughput of wood gasifiers compared with coal gasifiers. Coal gasification facilities are more suited for large applications requiring more than 10 billion Btu/day of energy input.

Wood gasification, however, can be very attractive for smaller applications, such as retrofitting a 75,000 to 100,000-lb/hour steam package boiler or a 200-tpd rotary lime kiln.

Fluidized bed system design

A fluidized bed system to supply 110-million Btu/hour of low-Btu gas to a 200-tpd rotary lime kiln is detailed below to demonstrate the applicability of wood gasification technology to the pulp and paper industry. The fluidized bed design for illustrative purposes is generic in nature and is based on a composite of information received from several gasifier manufacturers and inhouse Gilbert/Commonwealth information. A hog fuel with a 20% moisture content is the assumed feedstock for the design.

Combustion of low-Btu gas in a rotary lime kiln will require the replacement of the existing burner with a new low-Btu gas burner and its auxiliary equipment. Furthermore, the rotary kiln discharge hood must be pulled back and modified to accept the new burner. A schematic diagram of the kiln is shown in Figure 2.

The new burner should be designed to co-fire both low-Btu wood gas and fuel oil (or natural gas). The fuel oil serves three functions:

1. A majority of the time it serves as a continuous pilot with a minimum of fuel flow for the wood gas
2. It serves as a backup fuel when the wood gasifier is not operating
3. It is used for control to adjust the kiln temperature, if necessary.

Rotary kiln performance utilizing low-Btu gas is dependent on fuel combustion characteristics such as fluegas volume, adiabatic flame temperature, and combustion air requirements. Table 3 lists the combustion characteristics for the stoichiometric firing of low-Btu gas, natural gas, and fuel oil.

In general, the combustion of low-Btu gas will not result in the same heat absorption, thermal efficiency, flame length, or flame temperature as fuel oil or natural gas. As a result, a kiln capacity derating of 10% to 20% may result when low-Btu gas replaces natural gas or fuel oil. The kiln capacity can be maintained by firing an incremental amount of low-Btu gas above the conventional fuel heat duty. Other possible options to reduce derating involve the use of drier feedstock, preheating combustion air and/or gasification air, and co-firing low-Btu gas with 10% fuel oil or natural gas.

A reduction of the kiln's primary and secondary excess air requirement for low-Btu gas compared with natural gas or fuel oil can also reduce the incremental amount of low-Btu gas required to prevent derating.

TABLE 4: **Conceptual cost estimate for a 110-million Btu/hr fluidized bed gasification system to fire a rotary lime kiln**

Gasifier heat duty (million Btu/hr)	110
No. of gasifiers	1
Type	Fluidized bed
Capital cost, $ million (Second quarter 1982)	
Total direct installed cost	3.200
Total indirect cost	0.428
Total plant investment	3.628
Land cost	—
Working capital	0.131
Startup	0.350
Total project capital cost	**4.109**
Operating cost, $ million/yr (7,000 hr/yr)	
Wood feed cost (at $20/bone-dry ton)	0.924
Electric cost (at $0.04/kWh)	0.130
Direct labor	0.475
Net operating cost	**1.529**
Product gas cost, $/million Btu	**1.529**
First-year gas costs	3.20

Reduction of the combustion air requirement for low-Btu gas will also reduce the fluegas volumetric flow rate exiting the kiln. The fluegas volumetric flow for low-Btu gas will still be somewhat higher than conventional fuels, but not enough to significantly increase kiln dusting.

In summary, the steps required to retrofit the kiln from conventional fuel to low-Btu gas include:

- Replacement of the existing burner with a dual low-Btu gas/conventional fuel burner
- Reduction of the primary air supply to provide a multilouver outlet damper on the primary fan discharge
- Reduction of the kiln secondary air supply by the addition of seal devices around the firing hood
- Installation of a water spray, if necessary, on the suction side of the kiln induced draft fan to prevent exiting fluegas from exceeding the design temperature of the fan.

Conceptual cost estimate

A conceptual cost estimate for a fluidized bed gasification system to produce 110-million Btu/hour of low-Btu gas for a 200-tpd rotary lime kiln is shown in Table 4. Included in the direct installed cost are the wood storage unit, wood preparation unit, gasification unit, ash storage unit, kiln burner retrofit equipment, and utility support systems.

The direct installed cost includes all architectural, structural, civil, piping, equipment, instruments and controls, electrical, and site preparation costs.

The total capital cost for the facility is $4.109 million, and the annual operating cost is $1.529 million based on a 7,000-hour/year operating level. All costs are second-quarter 1982 U.S. prices.

The first year average gas cost is $3.20/million Btu based on a fixed capital charge rate of 22.69%/year. The financial parameters used to calculate the first-year average product gas cost are shown in Table 5. The financial parameters used in this table assume a stable economy with accompanying moderate interest rates.

TABLE 5: **Assumptions used in economic analysis**

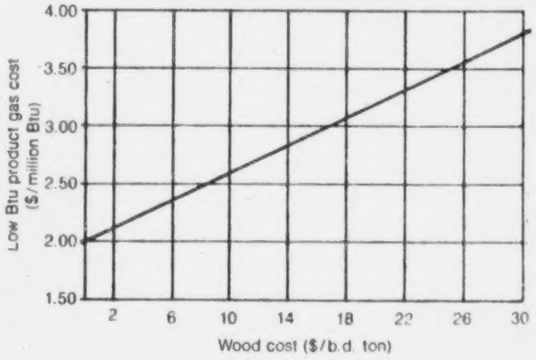
Plant life (yrs)	20
Construction period (yrs)	2
Debt period during construction (months)	8
Interest rate (%)[1]	10.5
Working capital	30 days wood plus 1% TPI
Discounted cash flow rate of return (%)	15
Federal tax rate (%)	48
Local taxes and insurance (%)	2
Depreciation	14 year sum-of-digits

[1] The fixed capital charge rate based on the above financial parameters is 22.69%/yr

$$\text{First year gas cost, \$ million Btu} = \frac{N + 0.2269\,(TPC)}{G}$$

N = operating cost, TPC = total project capital cost
G = product gas rate in trillion Btu/yr

FIGURE 3: **Low Btu product gas cost vs wood feed cost for a 110-million Btu/hr fluidized bed gasification facility**



A plot of first-year product gas cost vs wood feedstock cost is shown in Figure 3, based on the same total capital cost estimate and financial parameters mentioned previously. As illustrated by this figure, the economic competitiveness of low-Btu gas is sensitive to the availability of low-cost wood feedstock.

Conclusions

Wood gasification technology in the pulp and paper industry has numerous applications. Low-Btu gas may be used to replace natural gas and fuel oil in lime kilns, boilers, and dryers in a typical pulp and paper mill.

In the 1980s, with the advent of natural gas deregulation as well as the possibility of escalating fuel oil prices, wood gasification should provide an economical alternative to conventional energy uses for the pulp and paper industry. □

Sodium hydrosulfite markets poised for recovery

By BARRY SHOCKETT

The U.S. domestic market for merchant sodium hydrosulfite has been on a downward trend for two years but is expected to recover somewhat in 1983. Demand in 1982 was an estimated 44,000 tons, compared with 55,000 tons for both 1980 and 1981. However, exports rose again last year to 18,000 tons, returning to the 1980 level. Exports had dropped in 1981 to 15,600 tons.

There is still no domestic source in Canada for sodium hydrosulfite, and both merchant hydrosulfite and the Borol precursor for onsite production are imported. Last year pulp and paper industry demand dropped about 6% due to the drop in pulp and paper production, but an increase to around 18,000 tons is expected in 1983.

U.S. statistics, sodium hydrosulfite* (000 short tons)

	1980	1981	1982e	1983e
Nameplate capacity	75	73.5	61	67
Production	73	71	60	66
Imports	0.1	0.3	1.9	2
Exports	18.1	15.6	17.7	18
Apparent consumption	55	55.7	44.2	50
Pulp and paper	16.5	16.7	16.7	18

*Not including onsite production via Borol

Sources: Bureau of Census, Dept. of Commerce; PULP & PAPER and industry estimates

Canadian statistics, sodium hydrosulfite* (000 short tons)

	1980	1981	1982e	1983e
Imports[†]	10.5	11.6	11	11
Total demand	10.8	11.5	10.8	11
Pulp and paper	9.5	10.3	9.7	9.9

*Not including onsite production via Borol

[†] No sodium hydrosulfite is produced commercially in Canada

SODIUM HYDROSULFITE

UNITED STATES

Uses: Sodium hydrosulfite is used as a bleaching agent for mechanical and deinked pulps. The textile industry is the largest consumer, and clay refining and specialty chemicals consume some.

Demand: Although total domestic demand for sodium hydrosulfite dropped substantially last year (almost 20%), pulp and paper usage remained relatively steady at about 16,700 tons. This is due to an increased customer base, although individual mill use was generally down because of lower production of most pulp and paper grades. An estimated 8,700 tons (100% basis) were produced onsite via the Borol process. The reduction in total demand boosted pulp and paper's share of the market to almost 38%. Exports last year were over the 17,500-ton mark—a reversal from 1981.

Sources: There are now two sodium hydrosulfite producers in the U.S.—Virginia Chemicals Inc. and Olin Corp. Virginia Chemicals acquired the number-three producer in late 1981, but then closed the facility and now has three facilities. Morton-Thiokol's Ventron division is the sole supplier of Borol solution.

Availability: Although nameplate capacity has decreased because of the Royce closure, operating rates have remained over the 95% level. No shortages are foreseen in the near future.

Pricing: Competitive pressures and the recessionary climate prevented a price increase from occurring in 1982. The 60¢/lb price originally posted on Dec. 1, 1981 is still in effect. If the economy recovers as predicted, there may be a 5% hike after midyear. Pricing history: 1982, 60¢/lb, proprietary blends, f.o.b. producing point; 1981, 55¢-60¢/lb; 1980, 43.5¢-55¢/lb.

Forecast: As the economy recovers, pulp and paper usage should increase in 1983 between 7% and 8%. Total merchant demand is expected to reach the 50,000-ton level.

CANADA

Uses: Sodium hydrosulfite is used mainly by newsprint and groundwood-specialties mills to bleach mechanical pulps. The other minor end-use is vat dyeing of cotton.

Demand: In 1982, an estimated 9,700 tons of merchant sodium hydrosulfite were used by the pulp and paper industry, out of a total demand of 11,000 tons. A modest increase to just under 10,000 tons is expected for 1983. On a 100% basis, about 17,500 tons of hydro were produced in 1982 via the Borol process.

Sources: The major supplier to the mills is VirChem Canada Inc., which imports from its U.S. parent. Several distributors bring in product from offshore sources.

Availability: The Canadian market is relatively small, and thus no shortages are likely in the foreseeable future. 1982, market; 1981, market; 1980, market.

Pricing: Exchange adjustments over the past few months have brought the price of blended sodium hydrosulfite to 71¢/lb, while unblended product went up Apr. 1, 1983 4.5¢/lb to around 65.5¢/lb. Pricing history: Blended sodium hydrosulfite: 1982, 69¢-71¢/lb; 1981, 59¢-64¢/lb; 1980, 51.4¢/lb; 1979, 50.5¢/lb. Nonblended: 1982, 61¢/71.5¢/lb; 1981, 66.4¢-71.5¢/lb; 1980, 56¢-66¢/lb.

Forecast: The demand for both merchant hydrosulfite and Borol product are expected to increase modestly in 1983. Borol usage should rise about 440 tons (12% basis), while demand for the merchant grade should increase about 220 tons.

Mr. Shockett is consulting editor-chemical markets for PULP & PAPER.

PULP & PAPER

June 1983

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Mechanical Pulping

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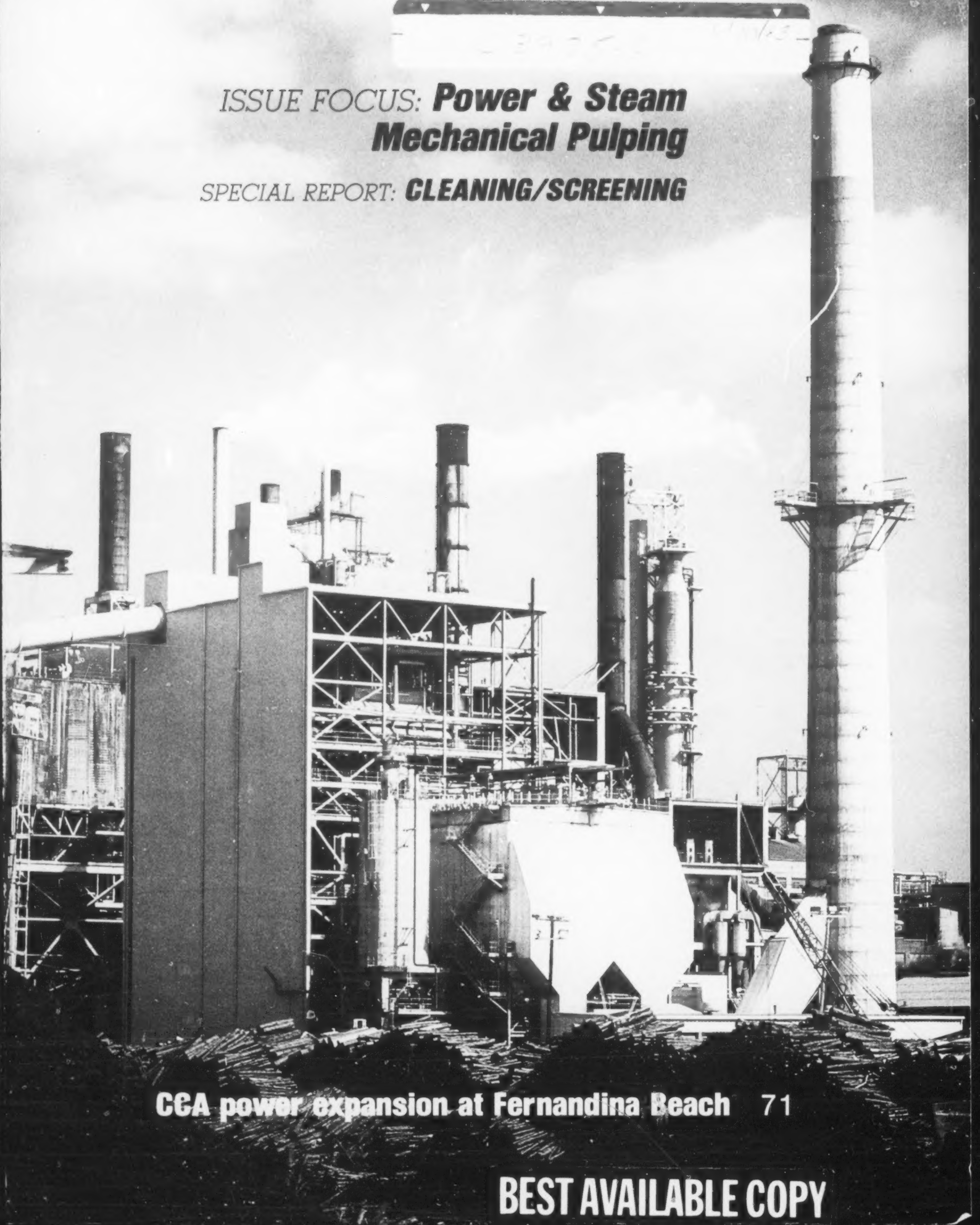

CCA power expansion at Fernandina Beach 71

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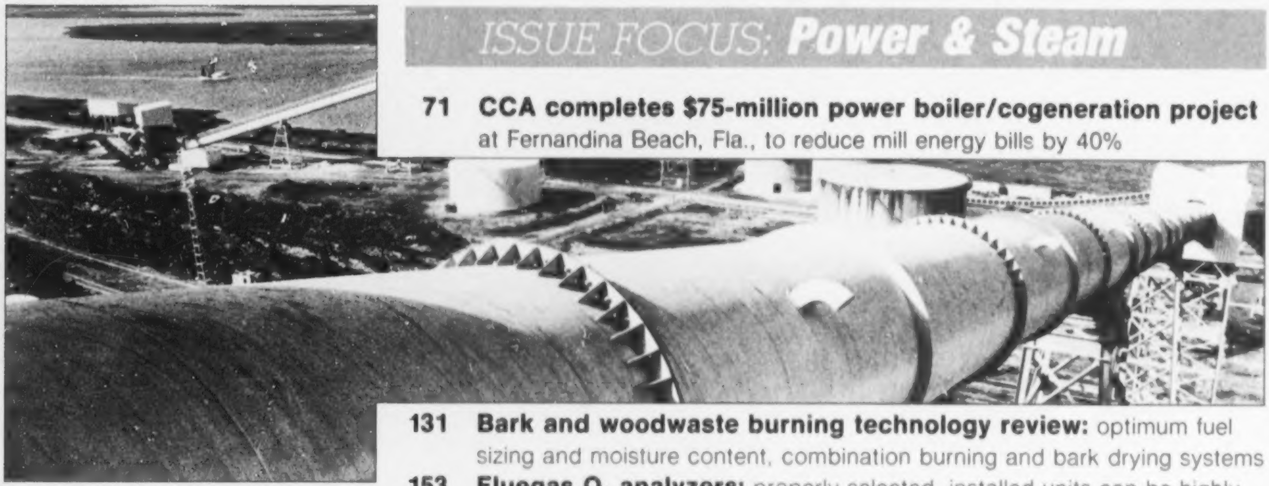

CCA'S POWER BOOST 71

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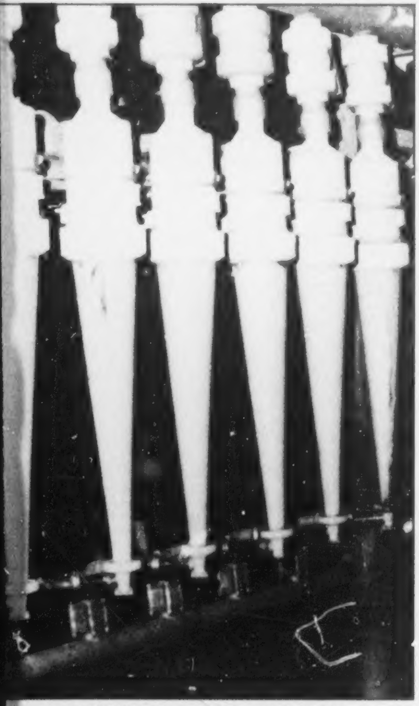

CLEANING SYSTEM AT ALABAMA 102

COVER: *Container Corp. of America's new 770,000-lb/hour coal-fired power boiler at Fernandina Beach, Fla. Cover story begins on page 71. (Photo by Scott Robertson, courtesy of BE&K Inc., Birmingham, Ala.*

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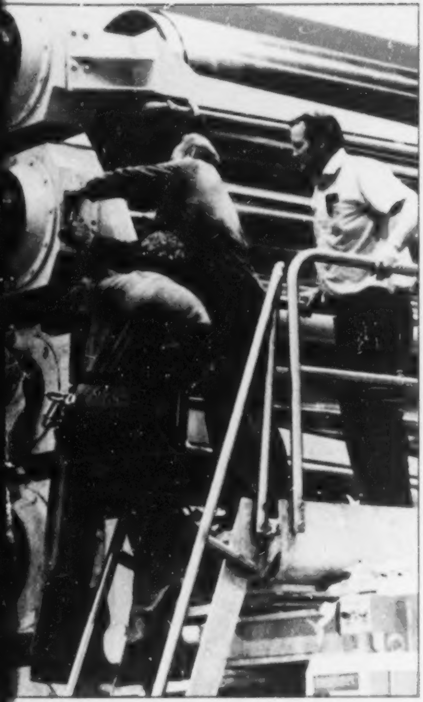
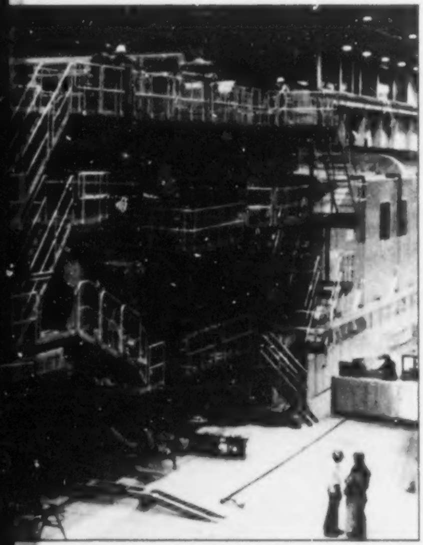


BCFP'S NEW BEL BAIE 74



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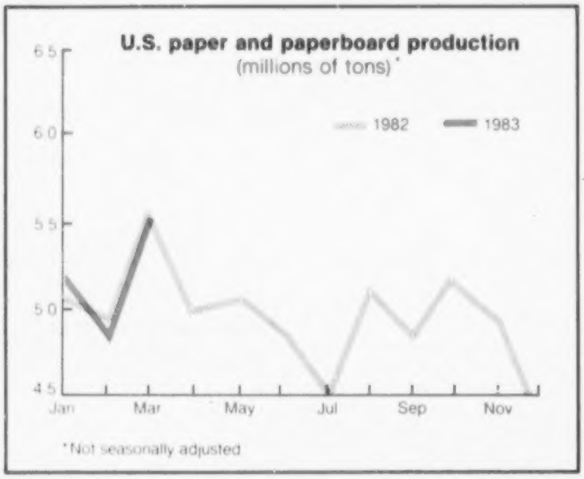
MONTH IN STATISTICS

U.S. paper and paperboard production totaled 5.5 million short tons in March, down 1.1% from year-earlier levels, according to the American Paper Institute. The first-quarter production trend, adjusted for seasonal and workday factors, was 62.3 million tpy, up 2.1% from last year and even with the record-year 1981.

Among major grades, production of uncoated free-sheet paper was up 6.6% from last year, while coated paper gained 7.4%. Tissue production showed an increase of 2.1% over the first quarter of 1982. Packaging grades remained weak, with kraft paper production down 4.3% from year-ago levels. Among paperboard grades, kraft linerboard gained 3.6% over March, 1982, and recycled paperboard was up 2.6%. Production of kraft linerboard for export remained strong, showing an 11.6% jump over first-quarter 1982 levels.

Total Canadian newsprint shipments totaled 676,000 metric tons in March, down 10.6% from a year ago, said the Canadian Pulp & Paper Assn. Newsprint mill operating rates were 80%, compared with 91% last March. Woodpulp shipments totaled 352,000 metric tons, down 8.9% from year-ago.


U.S. paper and paperboard production
(millions of tons)*

*Not seasonally adjusted

		Latest month (000 short tons)	% change from year ago	Annualized year-to-date (000 short tons)	% change from year ago
PAPER & PAPERBOARD PRODUCTION[1]					
Newsprint	March	448	−3.9	5,235	−2.1
Uncoated groundwood (s)	March	124	2.4	1,388	0.3
Coated paper (s)	March	453	4.9	5,283	7.4
Uncoated free sheet (s)	March	766	14.2	8,519	6.6
Unbleached kraft packaging and industrial (s)	March	313	−8.7	3,804	−4.3
Tissue	March	395	2.6	4,626	2.1
Total paper	**March**	**2,774**	**2.2**	**31,914**	**2.2**
Kraft linerboard, unbleached	March	1,306	2.7	14,465	3.6
Semichemical medium	March	395	—	4,491	0.2
Bleached paperboard	March	335	0.6	3,843	1.3
Recycled paperboard	March	617	0.3	7,023	2.6
Total paperboard	**March**	**2,745**	**1.1**	**30,814**	**2.0**
Total paper and paperboard*	**March**	**5,519**	**−1.1**	**62,728**	**2.1**
PULP, WASTEPAPER & FIBER[2]					
Total woodpulp production	February	4,045	−3.4	49,752	0.8
Market pulp production	February	488	−8.4	5,597	−2.3
Wastepaper consumption at paper/board mills	February	1,106	−9.4	13,698	4.8
Pulpwood consumption (cords)	March	6,771	4.0	82,596	6.7
CONVERTED PRODUCTS STATISTICS[3]					
Corrugated box shipments (billion ft²)	March	29.891	3.5	60.586†	2.9
Containerboard inventories at box plants	Mar. 1	2,462	−2.4		
INTERNATIONAL TRADE[2]					
U.S. paper imports (including products)	February	554	−9.3	7,427	−3.5
Imports of Canadian newsprint	February	432	−20.0	5,837†	−12.0
U.S. paper exports (including products)	February	374	16.1	4,341	14.6
Exports of unbleached kraft linerboard	March	195	8.3	2,123	11.6
Exports of woodpulp	February	263	−13.2	2,983	−5.1
CANADIAN STATISTICS[4] (reported in metric tons)					
Total newsprint shipments	March	676	−8.8	1,885†	−10.6
Operating rates	March	80%	91%	81%	94%
Inventories held by U.S. consumers	Mar. 31	1,260	−24.6		
Woodpulp shipments (export only)	March	352	−9.7	970†	−8.9
Operating rates	March	83%	91%	82%	88%

[1] American Paper Institute. [2] API, Bureau of Census, American Pulpwood Assn. [3] Fiber Box Assn., Paperboard Packaging Council. [4] Canadian Pulp & Paper Assn.
*Includes construction and wet machine grades. †Not annualized. ‡Not directly comparable to year ago because of coding change. (s) = shipments.

FINANCE

First-quarter profits drop—but upturn seen

Despite some faint signs of improving market conditions, U.S. pulp and paper industry profits dropped 26.1% in the first quarter of 1983 from a year earlier. And even though lower interest rates are causing a rebound in housing starts, forest product companies only reported a 7.7% increase in their still highly depressed earnings, financial reports from seven major companies show. International Paper Co. reported first-quarter earnings of $69.5 million compared with $60 million a year ago. However, first-quarter 1983 results included a pre-tax gain of $60 million from the sale of timber, while year-ago results included $17.2 million from the sale of tax benefits. Excluding these items, operating earnings only amounted to $9.5 million, a 78% drop from a year earlier.

Intense competition. St. Regis Corp. reported a 52% drop in profits to $11.2 million, which partly included sale of tax benefits. "Business conditions continue to be depressed for many of our products due to a climate of intense competition and reduced demand in the marketplace," commented William R. Haselton, chairman and CEO. Crown Zellerbach Corp. reported a profit of $20.4 million, after a similar size loss from operations in the final quarter of 1983.

The largest company still in the loss column was Mead Corp., which posted a first-quarter deficit of $11.9 million compared with a year-ago profit of $13.8 million. Among producers of unbleached paperboard and packaging, Union Camp Corp. reported a 17% decline in earnings to $26.8 million.

Tissue producers continued to show the best earnings results, helped by the less cyclical nature of their markets, cost-reduction programs, and lower fiber costs. Fort Howard Paper Co., for example, posted a 7.8% earnings gain despite highly competitive markets and continuing pressure on selling prices. Scott Paper Co.'s profits were up 2.6% to $19.1 million, while Kimberly-Clark's declined 9.0% to $52.5 million.

Wood products strengthen. A number of forest products companies registered dramatic increases as prices and demand surged, although profit margins remained highly depressed. Potlatch Corp., for example, posted a 116.7% increase in profits to $9.7 million on a 6.9% rise in sales to $215.2 million. Weyerhaeuser Co., however, showed a 60.6% decline in earnings to $22.5 million on a 3.0% rise in sales to $1.09 billion. Georgia-Pacific earnings were up 20.0% to $30.0 million, on sales of $1.4 billion, up 18.3%. Louisiana-Pacific Corp. reported earnings of $4.3 million compared with a loss in the corresponding 1982 quarter, while sales jumped 22.2% to $240.3 million.

Canadian mills in red. Canadian pulp and paper companies continued to be hurt by the worldwide recession in the first quarter, with most firms reporting losses or significant declines in earnings from year-earlier levels. Sustained pricing weakness in market pulp and newsprint continued to depress Canadian financial statements, according to reports from ten producers. Lumber markets began to firm as the quarter progressed, however, helping to offset declines in pulp and paper sectors.

The ten firms reported a combined operating loss of C$31.2 million for the quarter compared with profits of $26.9 million in first-quarter 1982, on sales of $2.3 billion, down 5.1% from year-earlier levels.

U.S. PAPER/FOREST PRODUCTS RESULTS

	First quarter ($000)			
Paper companies	**Sales**	**Change 1983/82**	**Earnings[1]**	**Change 1983/82**
Chesapeake	$59,900	0.3%	$1,000	−47.4%
Consolidated	137,295	1.1	10,597	−2.8
Crown Zellerbach	617,100	−14.9[2]	20,400	264.0[2]
Federal Paper	125,721	2.2	149	−97.2
Fort Howard	133,355	10.8	23,500	7.8
Glatfelter	61,217	−10.9	4,417	−23.5
GN Nekoosa	371,700	1.0	15,200	−30.9
Hammermill	356,143	9.3	3,313	−53.3
Intl. Paper	1,088,100	8.5	9,500[3]	−77.8[3]
James River (1/23)[4]	421,855[5]	129.0	11,064[5]	152.0
Kimberly-Clark	811,000	10.4	52,500	−9.0
Longview (1/31)[4]	80,737	−13.1	(2,772)	n.m.
Mead	656,087	−4.9	(11,970)	n.m.
Mosinee	24,013	9.0	1,216	19.0
Pentair	69,872	3.0	1,715	−22.9
St. Regis	649,822	−3.9	11,226	−52.0[7]
Scott	567,463	−2.2	19,118	2.6
Sonoco	156,377	27.2	7,073	6.1
Sorg	20,506	2.6	729	n.m.[8]
SW Forest	142,000	−2.0	(6,855)	n.m.
Stone Container	119,374	13.2	(962)	n.m.
Union Camp	421,010	13.0	26,084	−16.9
Wausau (2/28)[4]	42,193	−5.9	1,202	n.m.[8]
Westvaco	343,764	0.3	7,802	−6.3
Willamette	247,225	15.4	3,737	n.m.[8]
Total	**7,723,809**	**5.3**	**209,703**	**−26.1**
Forest products				
Boise Cascade	770,980	8.0	11,130	100.2
Champion Intl.	1,001,175	10.5	8,256	1,238.0
Georgia-Pacific	1,419,000	18.3	30,000	20.0[6]
Louisiana-Pacific	240,300	22.2	4,300	n.m.[8]
Pope & Talbot	66,853	12.1	2,187	155.2
Potlatch	215,152	6.9	9,717	116.7
Weyerhaeuser	1,089,483	3.0	22,460	−60.6[6]
Total	**4,802,943**	**10.8**	**88,050**	**7.7**
U.S. total	**12,526,752**	**7.3**	**297,753**	**−17.9**

CANADIAN PAPER INDUSTRY RESULTS

Abitibi	C$387,305	−6.6%[7]	C$781	−97.3%[7]
B.C. Forest	195,000	−1.5[7]	(16,900)	n.m.[7]
B.C. Resources	178,300	24.5	132	n.m.[8]
Con-Bathurst	342,000	−5.7	9,100	−48.3
Domtar	410,000	−6.3	500	−95.8[7]
Fraser	96,999	−5.6	1,681	17.6
Great Lakes	104,958	−20.7[7]	(7,721)	n.m.[7]
Mac. Bloedel	442,000	−12.4	(23,000)	n.m.
Rolland	52,300	23.3	1,683	n.m.
Scott	59,517	12.5	2,542	14.3
Total	**2,268,379**	**−5.1**	**(31,202)**	**n.m.**

1. Income after taxes, from continuing operations, excluding most significant nonrecurring items in both years (if reported on after-tax basis).
2. First-quarter 1982 includes CZ Canada interest sold effective year-end.
3. Excludes net gains of $60 million from sale of timber in 1983 quarter and $17.2 million from sale of tax benefits a year ago.
4. Period ended. Figures for James River are 3rd quarter, Wausau 2nd.
5. Latest quarter includes Dixie Northern operations acquired in July 1982.
6. Excludes effect of accounting change in 1982 first quarter.
7. 1982 figures restated by company.
8. Not meaningful due to loss in 1982 first quarter.

n.m. = not meaningful. ( ) = loss.

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Corrugating medium: Rising output, flat capacity should help operating rates

Statistics	**1981**	**1982**	**1983e**
Production, 000 tons			
Semichemical[1]	4,719	4,381	4,505
Recycled[1]	1,141	1,158	1,240
Total	5,860	5,539	5,745
Capacity, 000 tons			
Semichemical	4,988	5,273	5,249
Recycled	1,349	1,423	1,469
Utilization rates, %			
Semichemical	94.6%	83.1%	85.8%
Recycled	84.6	81.4	84.4
Imports, 000 tons[2]	52	47	50
Exports, 000 tons[2]	66	61	80
Apparent U.S. consumption			
000 tons	5,846	5,525	5,715
lb/capita	50.9	47.6	48.8
000 tons/$billion real GNP (1972)	3.89	3.74	3.77

[1] American Paper Institute [2] Bureau of Census

Grade structure: Corrugating medium includes paperboard made from both semichemical pulp and recycled fiber. In 1981, 78% was made from semichemical pulp furnish (which normally contains at least 20% recycled fiber), and 22% was "bogus" medium, made from recycled fiber. Basis weights of corrugating medium are 22, 26, 33, and 36 lb/1,000 ft². Standard sheet weight is 26 lb, which accounts for more than 80%. Bogus for equivalent uses is normally produced in slightly higher weights.

Production/capacity: In 1982, production of corrugating medium declined by 5.5% to 5.5 million tons, reflecting a 4.6% drop in corrugated box shipments caused by the deep slump in industrial production. Semichemical medium output dropped 7.2%, while recycled medium appeared to regain some market share by rising 1.5%. The increased competitiveness of recycled medium probably reflects reduced wastepaper and fuel oil costs.

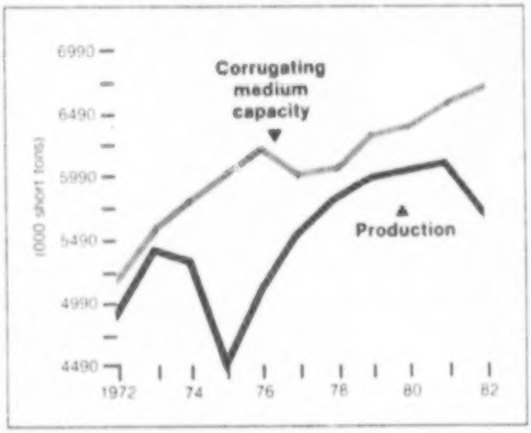
Operating rates for semichemical medium mills declined sharply from 94.6% in 1981 to 83.1% in 1982, while rates of recycled medium mills only showed a slight decline in 1982, to 81.4%, after experiencing the brunt of the recession of the previous year. Hurting operating rates in 1982 was a 5.6% jump in medium capacity, with both semichemical and recycled showing about the same size increase.

New capacity included International Paper Co.'s 270,000-tpy semichemical medium machine started up at Mansfield, La., in late 1981, and MacMillan Bloedel's new 210,000-tpy semichemical machine, which came on at Pine Hill, Ala., in late 1982.

Outlook: In 1983, corrugating medium production is projected to rise about 3.7% to 5.7 million tons, reflecting about a 4.0% rise in corrugated container shipments and modest inventory reduction (35,000 tons).

Semichemical medium output was essentially flat for the first quarter and is projected to show a 2.8% rise for all of 1983. Recycled was up 11.6% for the first quarter and is projected to show a gain of 7.1% for the full year. However, it will lose some of its competitive edge as wastepaper costs begin to rise.

Operating rates are projected to rise to 85.8% for semichemical and to 84.4% for recycled medium in 1983, but actual rates will probably be somewhat higher once capacity figures are adjusted for a number of mill and machine shutdowns.



Estimated capacities of major U.S. companies are:

	Annual capacity (000 tons)			
	Semi-chemical medium	**Recycled medium**	**Total**	**Capacity share %**
1. Owens-Illinois	580	—	580	8.6
2. Weyerhaeuser	575	—	575	8.6
3. Container Corp.	235	155	390	5.8
4. Inland Container.	175	210	385	5.7
5. Willamette Industries	230	120	332	4.9
6. Champion Intl.	200	102	320	4.8
7. Packaging Corp. of America	254	—	254	3.8
8. Stone Container	247	—	247	3.7
9. International Paper	243	—	243	3.6
10. MacMillan Bloedel	210	—	210	3.1
11. Virginia Fibre	208	—	208	3.1
12. Alton Packaging	—	200	200	3.0
13. Great Southern	176	—	176	2.6
14. Crown Zellerbach	91	84	175	2.6
15. Weston Paper	135	—	135	2.0

U.S. capacity (1983): **6.7*8 million tons**
Capacity share of top five companies: 33.7%
Capacity share of top ten companies: 52.6%

Prices: Corrugating medium producers implemented a $20/ton price increase in March and April, which brought the list price of 26-lb semichemical medium back to $260/ton. Prices will probably not fully return or exceed their former prerecession list level of $290/ton until late this year or early 1984.

Pricing: Pricing history of 26-lb semichemical medium in the East is as follows: 1970, $110/short ton; 1971, $120; 1972, $120; 1973, $135; 1974, $185; 1975, $190; 1976, $195; 1977, $185/$195; 1978, $210; 1979, $260; 1980, $260; 1981, $290; 1982, $260.

Industry's safety record improved as a result of intensified efforts

Despite increases in both worker hours and accident cases reported, accident rates in U.S. pulp and paper mills declined during the past year

By GLORIA STASHOWER

☐ Declines in lost workdays and incidence rates caused by accidents in U.S. pulp and paper mills reflect a growing concern about safety in the industry. Last year, the total number of workdays lost dropped to 3,893 from 4,174 in 1981, and incidence rates were down to 7.7 from 8.6, according to the American Paper Institute. Incidence rates reflect the number of incidents to the number of workdays.

These improvements occurred despite the rise in total cases, which went to 11,432 in 1982 from 11,072 the year before, and the rise in work hours, which went to 296.8 million from 257.6 million.

This increasing emphasis on safety, however, is not the result of stricter regulations or better enforcement from the Occupational Safety & Health Administration. Instead, more companies are recognizing that achieving excellence in safety means not only sending your workers home hale and hearty, but also increasing their efficiency and productivity as well as corporate profits.

"Our outstanding safety performance has been one of the few bright spots in a difficult year," said Continental Forest Industries president Jess Belser. With safety a top priority in all units, several CFI locations have set records for hours worked without lost-time accidents.

CFI has received numerous national and regional awards, including two of the six annual safety awards presented by API last year. Workers' compensation rates spiraled between 1978 and 1981, but CFI's insurance costs rose only 6% overall and actually decreased by 35% in the company's 16 corrugating plants.

Annual safety awards

This year's API safety awards given at the annual Paper Week convention in March went to Scott Paper Co.'s S.D. Warren div., Buckeye Cellulose Corp., Procter & Gamble Co., International Paper Co., and Boise Cascade Corp.

At Boise Cascade, an intensive safety program begun in the mid-1970s has yielded impressive results. Company accident incidence rates have gone down continuously between 1975 and 1982, said Jerry Fields, Boise manager of safety and workers' compensation.

Even with a larger work force, the company's total number of industrial injuries decreased about 58% in that period. An especially notable record was made in 1982, when accidents were down 29% from the previous

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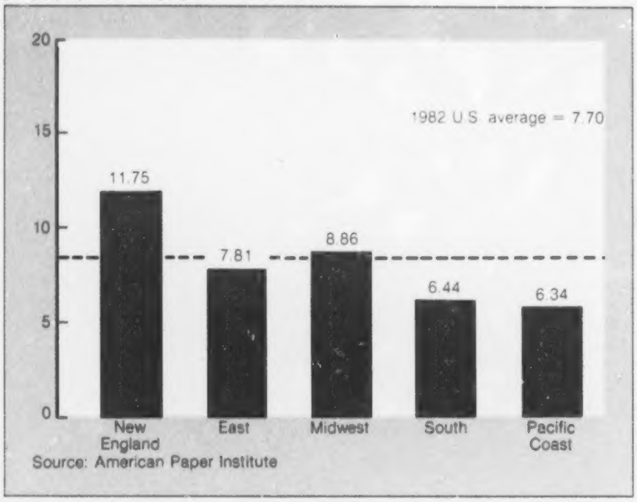
Mrs. Stashower is editor of internal communications at Continental Forest Industries.

TABLE 1: **1981-1982 comparison table**

	Number of reporting mills		Total working hours		Total cases		Lost workday cases		Incidence rates: Total cases		Incidence rates: Lost workday cases	
Region	**1982**	**1981**	**1982**	**1981**	**1982**	**1981**	**1982**	**1981**	**1982**	**1981**	**1982**	**1981**
New England	39	29	35,007,930.2	21,531,316.4	2,057	1,927	888	1,022	11.75	17.90	5.07	9.49
Eastern	38	42	37,649,541.25	32,290,616.8	1,470	1,684	545	617	7.81	10.43	2.30	3.82
Midwest	73	60	57,942,312.87	50,896,945.1	2,567	2,275	924	953	8.86	8.94	3.19	3.74
Southern	90	76	143,016,009.45	125,980,671.3	4,605	4,190	1,183	1,026	6.44	6.65	1.65	1.63
Pacific Coast	31	32	23,139,452	26,920,529.5	753	996	353	556	6.34	7.40	3.05	4.13
U.S. total	271	239	296,755,245.77	257,620,025.1	11,432	11,072	3,893	4,174	7.70	8.60	2.62	3.24

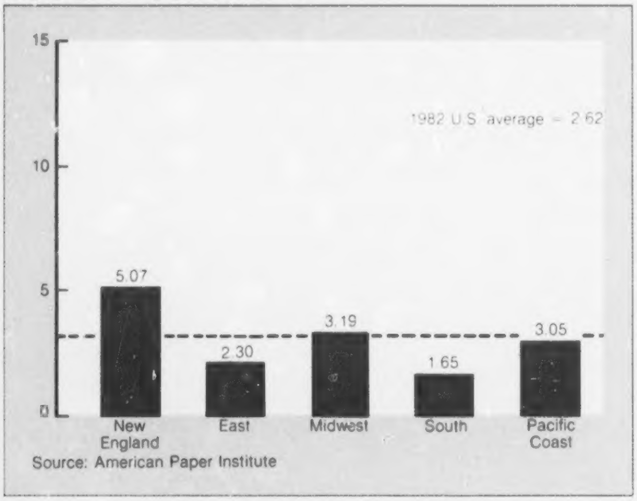
Source: American Paper Institute

FIGURE 1: **1982 total cases incidence rates, pulp, paper, and paperboard mills**



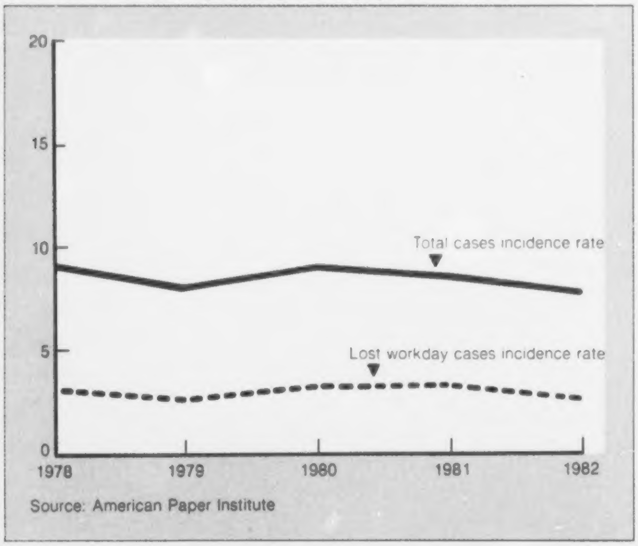
Source: American Paper Institute

FIGURE 2: **1982 lost workday cases incidence rates—pulp, paper and paperboard mills**



Source: American Paper Institute

FIGURE 3: **U.S. total—pulp, paper and paperboard mills**



Source: American Paper Institute

year; lost workdays declined 14%, and total workers' compensation costs dropped 3%.

Although results for any one year may be misleading, Fields can point to measurable and steady progress, which he attributes to "a visible, professional accident prevention program with structured management accountability." Accountability leads the list of common elements found in successful safety programs.

"Every level needs to know what's expected of it," said Bruce Higdon, manager of loss prevention for Champion International Corp.'s southern region. Champion begins at the top, with the chief executive officer receiving reports on the year's goals and objectives in loss prevention.

"Division heads are accountable for meeting those goals, and it is a significant part of their evaluation. It then goes down the line, with each operating manager, department manager and supervisor doing the same," he said.

Crown Zellerbach has a similar policy. "The safety performance of the managers of our various business units can weigh as much as 20% or 25% in determining their bonuses and merit increases," said Roger Larsen, CZ's corporate manager of health and safety. The company's accident incidence rates have gone down 35% in the past five years.

Boise Cascade and International Paper also base their review of managers' performance at least partially on their record in accident prevention.

Mills held accountable

Besides relating safety to a manager's compensation rewards, many companies now hold locations accountable. Dollars are added or subtracted from a facility's profit and loss statement based on its accident record for the previous year.

For the past four years, CFI has used a retrospective system. Each corrugated and fiber drum plant is budgeted a certain amount for workers' compensation. At the end of the year, adjustments are made according to the plant's success or failure in relation to its budgeted costs.

"Now our plants have not only human but dollar reasons to improve," said Dick Rogers, industrial relations manager of CFI's corrugated unit.

St. Regis has had similar results since retrospective ratings for all locations were introduced two years ago. Alan Kaplan, director of corporate safety and environmental health, noted that one plant was charged "an additional $40,000/month off the top" because of its poor performance over the past three years.

Such direct costs can carry a potent message, but safety professionals agree that covering workers' compensation claims is only the beginning of accident-related costs.

Numerous hidden expenditures include morale, labor relations and community image. In addition, a safe facility is usually cleaner, more efficient and more productive, executives said.

At CFI's Hopewell, Va., linerboard mill—now working on 2.5 million work hours without a lost-time accident—changes have been made in the way plant inspections are routinely done.

Julius Sheppard, mill supervisor of safety, health and training, personally conducts triannual inspections, some of which are unannounced. He is always accompanied by a supervisor and an hourly worker. Outstanding departments receive the Mill Manager's White Glove Award and their achievements are well publicized. Examples of poor housekeeping, on the other hand, are circulated in a report and are corrected.

Safety boosts productivity

Another benefit of a safety program that works is improved productivity through better use of people.

"We unite on a common goal—a safer mill—and we have to work in unison. It can't be we-they," said Rick Watson, Scott Paper Co.'s corporate manager of safety and security.

Scott has introduced small group sessions aimed at teaching people how to observe their own actions. "An individual becomes a team player aligned with the business purpose when he or she is involved as a person and not treated as just another variable in the production equation," said Watson.

"The only approach that works is to make people part of the problem-solving process," said Larsen. He sees CZ's declining accident rate as the direct result of involving employees in the development of a safety program at each location.

"You eliminate the adversary relationship and agree on acceptable standards of performance which the supervisor can then hold people to," he explained.

Both Watson and Larsen caution, however, that a worker-involvement program takes time to develop and may require professional help to implement. "It's best done in bite-size pieces," said Watson. "If a mill has been operating a certain way for years, there can be a fear of change," he noted.

One innovative approach to promoting safety through changing people's behavior was introduced in 1982 at St. Regis. An 11-session accident prevention training course designed for first-line supervisors was developed inhouse by safety and human resources personnel.

"Industry has done little to train supervisors in how to deal with people," said Kaplan. "Our emphasis used to be on how to recognize an unsafe condition, but over 90% of accidents are due to the unsafe acts of people."

Using video modules, role playing and key phrases, the course suggests ways of correcting an employee who isn't working safely, without creating resentment or antagonism.

Motivation is the key

Although commitment from corporate executives, mill managers and supervisors is vital in establishing a safety program, employees really determine its success, and their continued support should be promoted. "Management sets the tone, but the people make the record," said Albert Oetken, CFI vice president of brown mill operations.

"When one of our mills reaches a safety milestone, such as 2 million work hours at Hopewell, this is the only kind of record to which every single employee contributes, from a 50-year veteran to a one-week newcomer," he said.

Hopewell mill manager Leroy Coker communicates constantly with his workers to reinforce the importance of safety.

"Certain things in life are worthwhile," he wrote in a recent newsletter. "Taking care of ourselves and our fellow employees in an accident-preventive environment is one of them."

Motivational programs used to remind and reward people range from free coffee and donuts for an accident-free month to an elaborate barbecue for completing a safe year. Their value, however, may depend somewhat on the respect accorded the person sending the message and the support provided in the workplace.

Champion's Higdon points out that "a beautiful program on paper" can be destroyed when safety is placed second to production. From a business standpoint, he notes, the two should never be in conflict because a good safety program, in the long run, augments rather than slows production.

Companies with dramatically improved records acknowledge that the effort has to be constant and continuous. "Safety isn't just an accident," said CFI's Oetken. "It doesn't just happen."

The ongoing effort must include thorough orientation of new employees and a complete job safety analysis that gives step-by-step descriptions of procedures, defines potential hazards, and lists protective equipment required.

Thorough analysis is also needed to identify high-risk areas and put in controls and countermeasures. Some companies are now using database systems to store loss prevention information.

Indications are that safety in the paper industry is beginning to be managed like any other part of the business. That means setting goals, planning, organizing and controlling safety with the same attention as that given to production or quality. ☐

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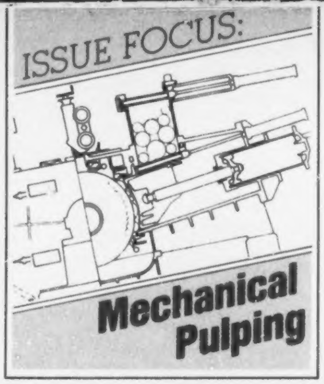

Pressure groundwood status report: ten mills now using the process

Mill experience has shown that pressure grinding has lived up to, or even surpassed, all expectations from original pilot studies conducted

By RISTO KAROJARVI and HANNU SALAKARI

☐ The development of pressurized grinding from the experimental stage into a commercial process has occurred very quickly. Tampella and MoDoCell started trials in 1977. The first pressure grinder was started up in May 1979 at the MoDoCell Bure mill in Sweden. Today, commercial pressure groundwood (PGW) plants have been operating from one- to two-and-a-half years, and PGW is used in all major paper and board grades that contain mechanical pulp.

Thirty-seven pressure grinders for ten mills around the world have been delivered or are on order today. The annual production capacity of these grinders exceeds 1 million tons (Table 1). Eight of the ten mill installations are in operation today. The latest of these, the huge Anjala PGW plant (capacity 1,480 a.d. tpd), was started up at the beginning of 1983. This article will discuss these installations and the operating results obtained from them.

Myllykoski: first commercial PGW plant

The Finnish paper company Myllykoski Oy is the world's largest producer of supercalendered (SC) paper. Its product, supercalendered uncoated, heavy-filled groundwood paper, is used mainly for rotogravure printing of magazines. The company has a reputation for high quality and is fully dedicated to SC papers.

Why did Myllykoski go to PGW? Due to a shortage of mechanical pulp capacity, a study of different alternatives was made. Thermomechanical pulp was not chosen because the company's research work indicated that TMP would have a negative influence on paper printability.

One of the first tasks for Tampella's PGW pilot plant in Anjala during the summer of 1979 was to produce 200 tons of pulp for paper machine trials at Myllykoski. These trials convinced Myllykoski that with PGW it could maintain SC paper printability and save chemical pulp to

TABLE 1: **PGW installations by grade**

Paper/board	Company/location	Country	Number of units	Wood species	a.d. tpd	Startup
Newsprint	Holtzmann & Cie AG, Maxau	W. Germany	6	Spruce, pine	350	1981
	Kajaani Oy, Kajaani	Finland	4	Spruce, pine	400	1982
	Leykam-Murztaler AG, Bruck	Austria	2	Spruce	160*	1982
	Tampella Ltd., Anjala	Finland	5	Spruce	615	1983
	Sappi Ltd., Ngodwana	S. Africa	2	Patula pine Taeda pine	145	1983
SC paper	Myllykoski Oy, Myllykoski	Finland	3	Spruce	165*	1980
	Madison Paper Industries, Madison, Maine	USA	4	Spruce, fir	310	1981
LWC paper	Oy Kaukas AB, Lappeenranta	Finland	2	Spruce	165	1981
Groundwood specialties	Tampella Ltd., Anjala	Finland	5	Spruce	615	1982
Folding boxboard	Tampella Ltd. Inkeroinen	Finland	2	Spruce	250	1983
	Oy Kymi-Kymmene AB, Juankoski	Finland	1	Spruce	65	1984
Market pulp	Modocell AB, Bure	Sweden	1	Spruce	55	1979
Totals			**37**		**3,295**	

*Includes units ordered, startup 1983

Mr. Karojarvi is technical manager, Tampella Ltd., Tampere, Finland, and Mr. Salakari is sales manager, TVW Paper Machines Inc., Boston, Mass.

such an extent that it was more economical to invest in pressure grinders than in conventional atmospheric grinders.

Myllykoski purchased two Tampella pressure grinders, which produce 110 tpd of pulp with a screened pulp freeness of 50 to 60 CSf. This first commercial PGW plant was started up at the end of June 1980.

Today, almost three years after the startup, the PGW pulp strength has considerably exceeded the level reached in trials. This strength improvement is based on operator experience and higher grinding temperature. Tear strength, especially, appears to depend strongly on grinding temperature (Figure 1). On No. 7 paper machine, where 30% to 40% of the mechanical pulp furnish is PGW, Myllykoski has been able to reduce the kraft content in the furnish by twice as much as the amount estimated in economic calculations used to justify the purchase of PGW.

Myllykoski owns, jointly with the New York Times Co., the Madison Paper Industries SC paper mill in Madison, Maine. This mill was expanded in 1981 to be the largest SC paper producer in North America. For this expansion PGW was chosen for the mechanical pulping process. Madison has very successfully brought more than 400 tpd of this new paper grade to the North American market, despite low paper demand. Madison has been operating without any curtailment since startup in the fall of 1981.

Myllykoski's confidence in PGW has been confirmed by the decision to expand its PGW plant at Myllykoski. Additional capacity will be obtained by adding a third pressure grinder to the system.

Operation experiences

All of the mills operating pressure grinders today also have regular grinders, a situation which provides an opportunity to compare pulp quality from these processes. The following discussions are based on operating data from these mills. All the quality comparisons have been made at equal pulp freeness.

A higher long-fiber content in PGW pulp has resulted in better tear strength in all mills. PGW's strength superiority over SGW has been from 40% (Holtzmann) to 58% (Kaukas).

The PGW process produces pulp with better bonding potential, resulting in improved tensile and burst strengths. The best results in this respect have been achieved at the Leykam-Murztaler mill in Austria, where the PGW breaking length is approximately 50% better than that of stone groundwood (SGW), and burst strength is about 70% better.

Better bonding properties have resulted in better surface strength and lower linting tendency in printing. For Leykam-Murztaler this consideration is most important because one of their main reasons for choosing PGW was to improve the offset printing capability of its paper.

Leykam-Murztaler has measured wet tensile strength of the pulps, and PGW has proved to be about 75% superior to SGW. This difference has clearly improved paper machine runability, although the share of PGW pulp in the furnish is only about 20%.

PGW pulp has a combination of pulp properties that matches the requirements of printing papers. Good strength is accompanied by excellent optical and surface properties. The opacity of PGW pulp has in all mills been equal to that of SGW.

On the other hand, PGW brightness with spruce is only one to three brightness points lower than SGW. For groundwood specialties and grades such as SC and LWC papers, PGW is very suitable, as confirmed by Myllykoski, Madison, and Kaukas.

Measurements at all PGW mills have shown that the specific power consumption in grinding to the same pit freeness level is equal (Table 2). In addition, most PGW mills are equipped with heat recovery systems recovering energy amounts of 40% to 50% of the power consumed in grinding.

The PGW process is well-suited to handle a wider raw material range than atmospheric grinding. The Holtzmann PGW mill normally grinds 40% to 50% pine. With atmospheric grinders, the mill is not able to use more than 10% to 15% pine because of quality reasons. Kajaani made a larger paper machine trial with pine PGW before the company chose pressure grinders because of an anticipated future shortage of spruce.

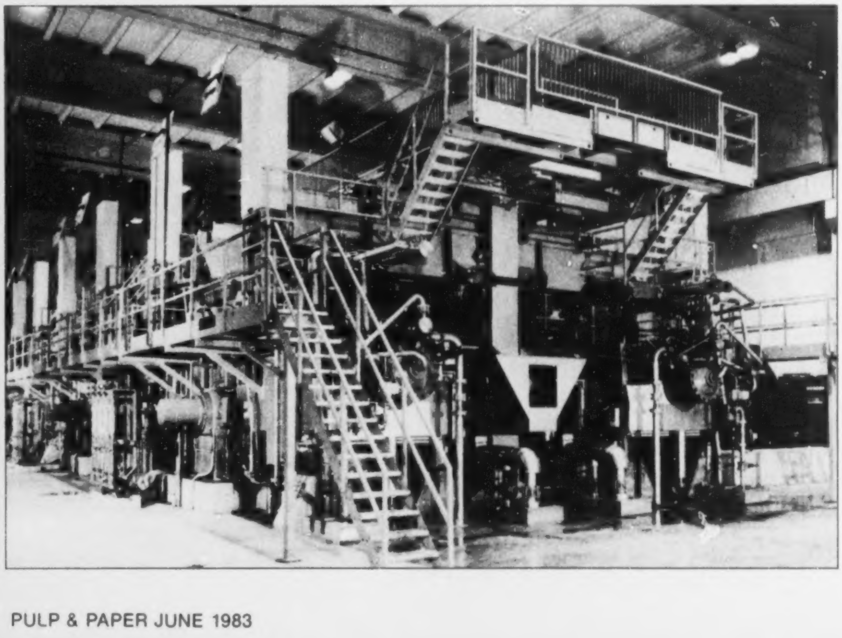

PHOTO A: The 320-tpd pressure groundwood installation at Holtzmann & Cie AG, West Germany.

PGW technology

PGW pulp mills are in some respects very different from conventional groundwood mills. The grinders are sealed and insulated, and open bull screens are not used at all. Very little steam escapes into the mill atmosphere. As a result, humidity is rather low, and room temperature is lower than normal in the grinder rooms.

Most mills have computerized instrumentation, which reduces labor requirements. In the new Anjala PGW plant, even log feeding to the grinders is remotely controlled from the operating room.

To supply the paper machine with pulp having an even better quality than the pit (raw) pulp, Tampella has conducted extensive screening studies at the Anjala pilot plant and at the Holtzmann PGW mill.

Based on these studies, a computer simulation has been developed that has been used with good results for designing the screening systems of the latest mills—such as Kajaani and Anjala—and also for optimizing process operation.

The design of the pressure grinder equipment has been very successful. With new machinery, few difficulties have occurred, and only small design changes have been needed. At Myllykoski, the uptime utilization of the pressure grinders was 86% during 1982. The downtime (14%) includes time lost due to reasons such as lack of power, lack of wood, lack of pulp demand, maintenance, and stone sharpenings.

The latest startups have been practically trouble-free, and the plants have reached their nominal production capacity within a few weeks of startup. For example, the Holtzmann PGW plant, which was designed for a nominal capacity of 350 a.d. tpd, is now normally producing 470 to 500 tpd.

The biggest operational problem, by far, has been the stone failures that occurred at several plants. Most of these failures have been of the same type, i.e., whole segments popping out from the stone core. Some of the failures have been caused by operational problems, such as heating the stone too quickly before startup or plugging the bottom stone showers due to high stock level in the grinder pit.

Research has shown that the main reason for these stone failures is that the fastening of the stone segments has not been satisfactory enough for operating at elevated temperatures. Stones with improved methods for segment fastening are now available, and with two of these stone types no such failures have occurred.

Today, a total of nineteen of these stones are operating successfully and the first ones have been in operation for 14 months.

Anjala mill

The most recent PGW startup was at Tampella's Anjala paper mill in Finland. The old Anjala groundwood mill, which was built in the 1930s, was making pulp for two paper machines producing groundwood specialities. This pulp mill was not an economical operation because of high labor requirements and maintenance costs.

The company decided to expand paper production capacity at Anjala by installing a new newsprint machine and by changing the nearby Inkeroinen board mill from wastepaper-based grades to production of folding boxboard using groundwood filler. Furnish for the expansions is PGW.

The new PGW plant, with a capacity of 1,480 tpd, consists of four production lines, one for each paper or board machine. A total of 12 pressure grinders are tandem-driven by six 16,300-hp, 300-rpm motors. The grinders take 5-ft-long spruce logs. The whole PGW plant has five operators per shift, two of which take care of feeding the logs to the grinders.

Table 3 lists pulp test results for three types of mechanical pulps produced at the Anjala mill from the same raw material. The SGW is from the old groundwood mill, which has since been shut down and demolished. TMP comes from a 170-tpd plant operating at the site. PGW values are from early operations. Fine-tuning, startup of the computer control system, and tuning of the reject refining are expected to increase future PGW strength considerably.

At this stage, experience at Anjala has shown that the PGW pulp has improved paper machine operation. The mill reports that on No. 1 paper machine, kraft content

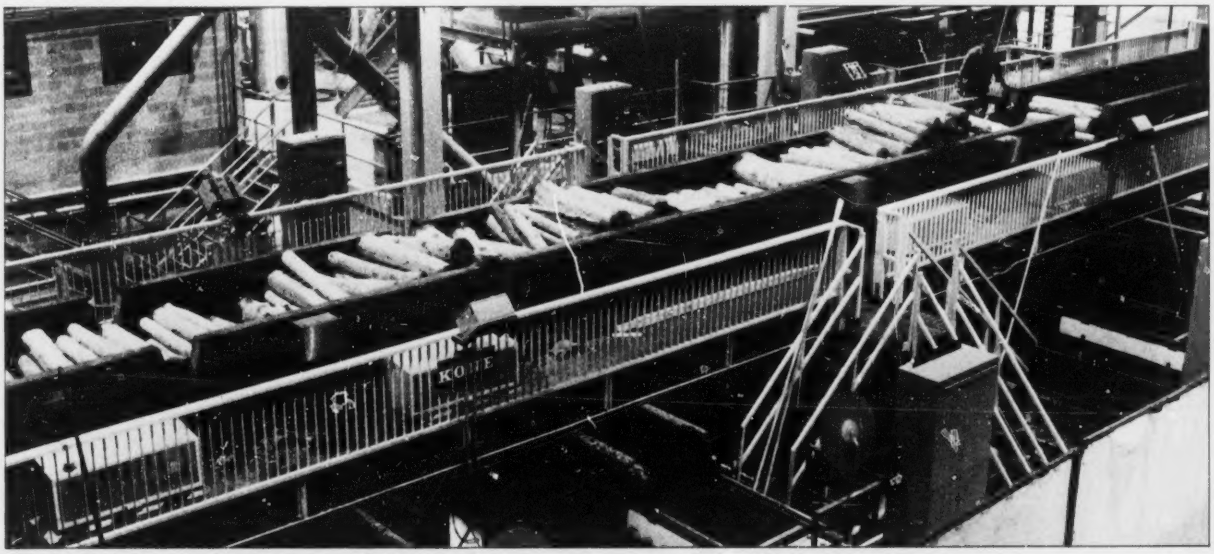

PHOTO B: Madison Paper's 280-tpd installation.

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has been reduced to 5% to 7% total. In spite of the reduced amount of chemical fiber, paper surface strength has been improved, and the average number of paper machine web breaks has been cut in half. The finished paper sheet has one to two points better opacity, and the surface is smoother.

In general, results of test runs in the pilot plant for the basic factors affecting the profitability of PGW (power consumption and pulp strength properties) have been shown to be correct in practice. The commercial mills are making stronger pulp than could be made at the original Anjala pilot plant. Optical and surface properties of PGW pulp have provided good paper printability, low show-through, and low linting propensity.

The improved pulp stone situation, grinder reliability, good economics, quality factors, and a wide raw material base all promise a bright future for PGW. ☐

FIGURE 1 **PGW tear strength vs raw pulp temperature. CSf level 80 to 120. Measurements according to scan standards**

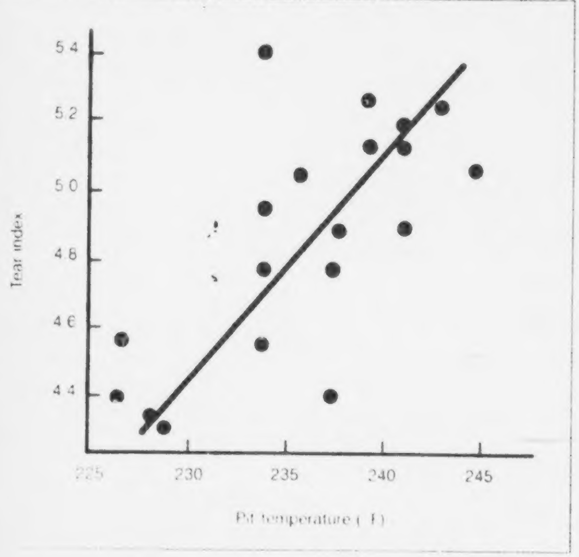


TABLE 2 **Specific power consumption of PGW and SGW processes in grinding**

PGW mill	Screened pulp CSf	Specific power consumption on grinders, hp-days/ton	
		SGW	PGW
Holtzmann	95	58.7	57.7
Kajaani	110	56.1	56.1
Leykam	90	58.7	62.2
Myllykoski	55	68.9	64.3

TABLE 3 **Pulp testing results with different mechanical pulps from Anjala. Measurements according to scan standards.**

	PGW	TMP	SGW
CSf	100	90	100
Tear index	5.0	6.5	3.5
Tensile index	31	33	27
Burst index	1.5	1.8	1.1
Brightness	61	59	63
Light scattering	68	58	68
Hp-days/ton stones/refiners	64	94	61
Hp-days/ton plant total	75	115	71

BURNING WOODFIBER FUELS

(Continued from page 134)

Direct fired rotary. These systems fire 15% of the bark throughput, generally as fines, in a separate furnace; exhaust the hot products of combustion into a rotary dryer; and reduce bark moisture from, for example, 55% to 40%. These systems require a separate fluegas exhaust system and particulate emission control collector. Systems of this type are engineered and supplied by Stearns-Roger Engineering of Denver, Colo., and M-E-C of Neodesha, Kans.

Waste-heat dryers. Waste-heat contact dryers utilize hot fluegas from existing bark-fired boilers. These systems base drying performance on the reduction of fluegas stack temperature from a range of between 400°F and 500°F to an exit temperature of about 200°F.

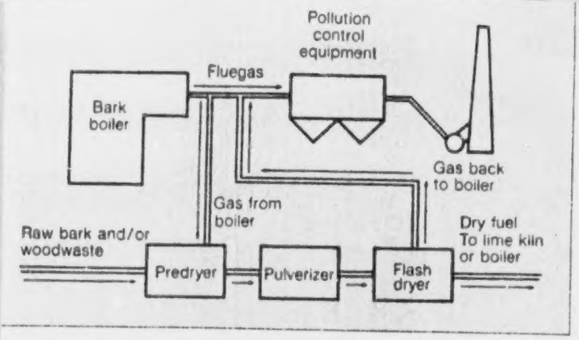
Systems in this category are engineered and supplied by the following companies: Bahco of Sweden (Figure 4); Carrier of Rexnord; Rader-Thompson of Beloit (Figure 5); and Flakt (Figure 6).

Indirect steam dryer. This system utilizes 150-psig turbine extraction steam in a series of 24-in.-dia shell and tube heat exchangers. Hogged bark passes through 6-in.-dia tubes. The bark steam vapor exhausts to the low-pressure mill system at approximately 60 psig.

Bark drying is an effective technique for reducing moisture in fuel, increasing boiler efficiency, and reducing fossil fuel demand. Several aspects of bark drying must, however, be considered in the dryer application:

- With moisture value in the range of 60%, as experienced in the Pacific Northwest, bark drying is a viable option. Reducing moisture content to 50%, for example, will lift grate capacity, reduce boiler fluegas volume, increase boiler efficiency, and reduce fossil fuel needs.
- Utilizing boiler fluegases is a viable option only when stack gas temperatures are in the 400°F to 500°F range. This can be the case for older, inefficient boilers.
- It is difficult to justify the application of a bark dryer for southern, 50%-moisture bark
- In modern, efficient bark boiler units with fluegas exit temperatures in the 300°F to 350°F range, there is insufficient temperature differential to justify waste heat bark drying
- The cost of a dryer system plus the cost of a boiler designed to fire dry bark will exceed the cost of a boiler designed to fire undried, 50%-moisture bark
- Bark dryers are, however, an effective means of extending and increasing the bark-burning capacity of existing bark-burning boilers. ☐

FIGURE 6: **Flakt bio-fuel system**


Pollution control equipment
Fluegas
Bark boiler
Gas back to boiler
Gas from boiler
Raw bark and/or woodwaste
Dry fuel To lime kiln or boiler
Predryer
Pulverizer
Flash dryer

Sodium sulfate demand recovering slowly in 1983

By BARRY SHOCKETT

Sparked by improving economic conditions, both total demand and pulp and paper usage of sodium sulfate should increase in 1983, although they are not expected to return to 1981 levels. Reduced output of byproduct sulfate in 1982 and plant closures produced a temporary shortage in domestic supply late in the year that was partially overcome by increased imports.

Byproduct sulfate output in Canada has not changed significantly in the last few years. Although total production was down about 2.5% in 1982, exports (mostly to the U.S.) reached a record level.

U.S. statistics, sodium sulfate (000 short tons)

	1980	1981	1982r	1983e
Capacity				
Natural	650	620*	470†	460*
Synthetic (byproduct)	600	600	600	600
Production				
Natural	583	608	450	405
Synthetic	556	536	480	540
Inventory change (year-end)	−4	−33	+26	0
Imports	230	291	391.5	435
Exports	129	124	111	120
Apparent consumption	1,236	1,278	1,236.5	1,260
Pulp and paper	593	613.5	593.5	608
Detergents	482	498.5	482	485
Other (glass and miscellaneous)	161	166	161	167

*40-kst plant closed April 1981; reopened January 1983
†200-kst plant closed March 1982
Sources: Bureau of Mines, U.S. Dept. of the Interior; Bureau of Census, U.S. Dept. of Commerce

Canadian statistics, sodium sulfate (000 short tons)

	1980	1981	1982	1983e
Capacity*	951	940	944.5	925
Production	653.5	698.5	681.5	678
Inventory change	−25.5	+3	+22	0
Imports	22	14	19	22
Exports	271	313.5	405.5	383
Apparent consumption	379	402	317	315
Pulping	291	313	237	231.5
Detergents	64.5	64	56.5	59.5
Other†	23.5	25	23.5	24

*Includes 107-tpy byproduct capacity
†Including glass, textiles, animal feeds, miscellaneous

SODIUM SULFATE

UNITED STATES

Uses: Sodium sulfate (saltcake) is the main source of makeup sodium and sulfur for kraft pulp mills. It is also used for detergents and by the glass industry.

Demand: In 1982, the pulp mill demand for sodium sulfate dropped to 593,500 tons, down 3% to 4% from 1981. Detergent applications consumed about 482,000 tons. Pulp mill demand is expected to increase slightly in 1983.

Sources: Three firms mine natural sodium sulfate—Great Salt Lake Minerals & Chemicals, Kerr-McGee Chemical and Ozark-Mahoning (div. of Pennwalt). The temporary shutdown of Great Salt Lake's plant in April 1981 and the permanent closure of Kerr-McGee's trona facility reduced the share of natural sulfate capacity to 44% of the total in 1982 (from 52% in 1980). The major byproduct (synthetic) sulfate producers are Allied Chemical, Avetex, Climax Chemical, Diamond Shamrock, Koppers, and Morton Salt Div.

Availability: If the rayon, chrome chemicals and lithium industries' output increases, thus raising byproduct production, no shortages should occur. 1983, tight to market; 1982, market to tight; 1981, market; 1980, tight to market.

Pricing: On Jan. 1, 1983, list prices of saltcake rose $5/ton to $99/ton on the West Coast and $91/ton in the South. Canadian saltcake for export to the U.S. also rose Jan. 1 to C$82/ton, f.o.b. mine. Price history: 1982, $79-$94/ton; 1981, $68-$79/ton; 1980, $60-$68/ton.

Forecast: Byproduct sulfate production is predicted to increase substantially in 1983 as the economy improves. Sodium sulfate output is expected to rise modestly.

CANADA

Uses: Kraft pulp mills consume most of the saltcake in Canada.

Demand: Pulp mills consumed about 237,000 tons of saltcake in 1982, vs the 313,000 tons reportedly purchased by the mills in 1981. Mill demand is forecast to drop 5,500 tons in 1983.

Sources: Five natural sulfate producers who account for 88% of capacity (in descending order of nameplate) are Saskatchewan Minerals, Sodium Sulfate Div.; Hudson Bay Mining & Smelting's Francana Minerals Div.; Midwest Chemicals; and Alberta Sulphate and Ormiston Mining & Smelting with the same capacity.

Availability: The available surplus can handle domestic demand, despite increased exports. 1982, market; 1981, market; 1980, market; 1979, market.

Pricing: The price of omestic saltcake held steady for a year at $75/ton until a $6/ton boost on Apr. 1, 1983. Pricing history: 1982, $70-$75/ton, bulk, f.o.b. producing point; 1981, $55-$70/ton; 1980, $50-$55/ton; 1979, $50/ton.

Forecast: Pulp and paper's share of total sulfate demand is expected to dip slightly to 74% (77% in 1980) in 1983. In the longer term, use by mills should decrease, on average, about 2%/year to slightly less than 210,000 tons in 1987.

Mr. Shockett is consulting editor-chemical markets for PULP & PAPER.

PULP & PAPER

July 1983

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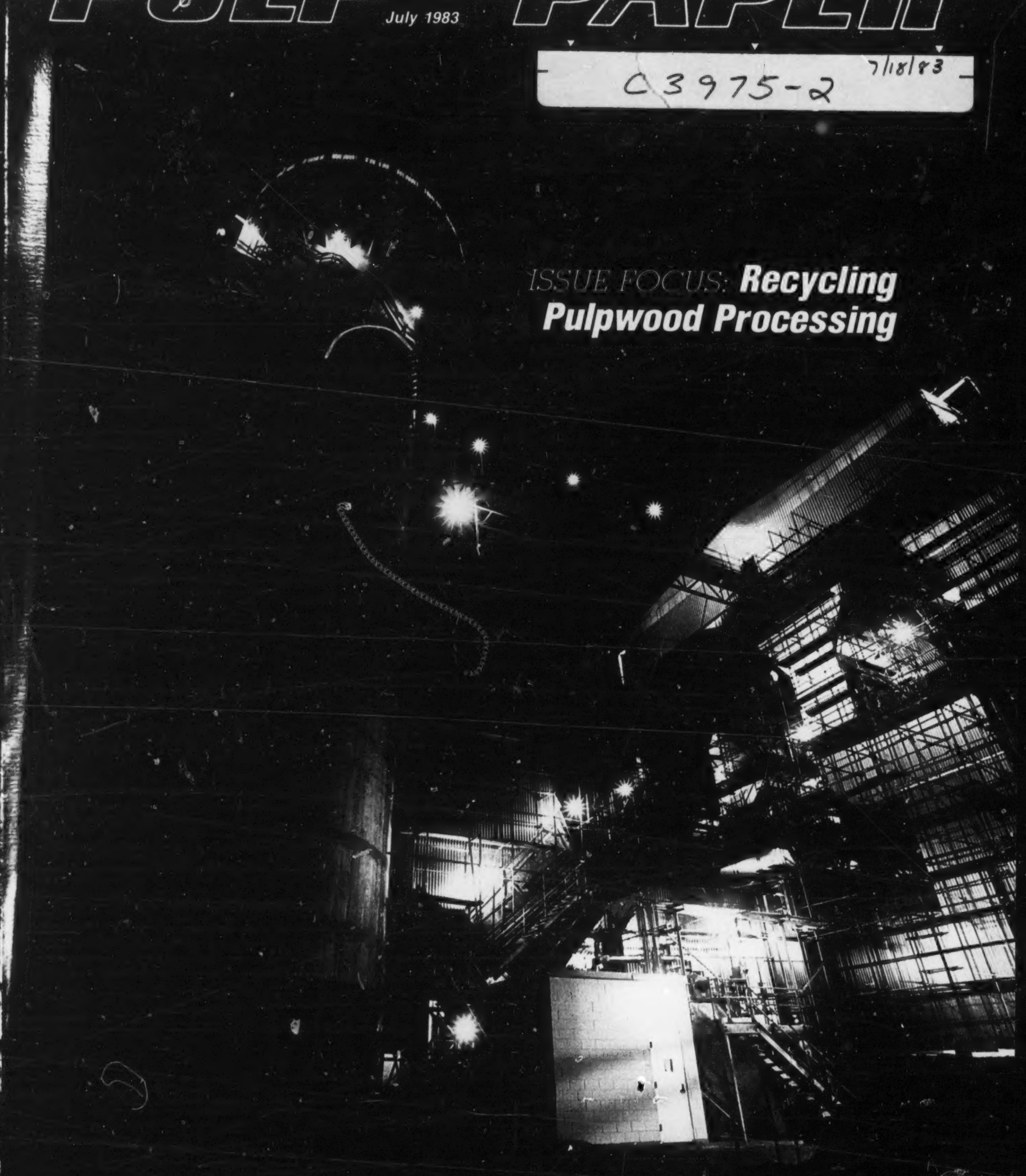
Pulpwood Processing



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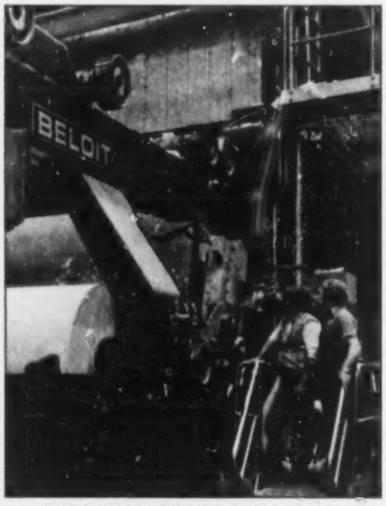

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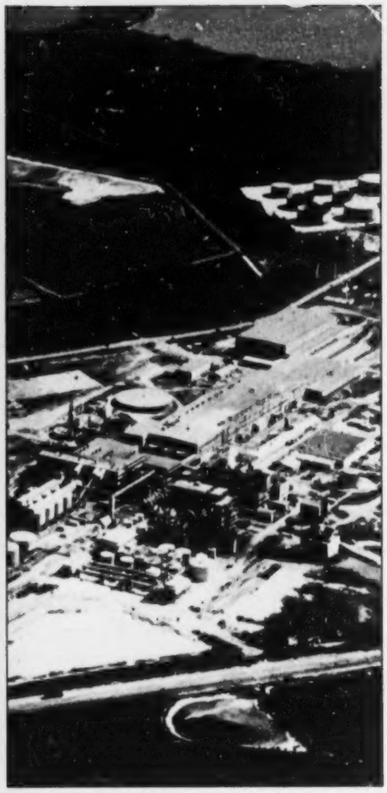
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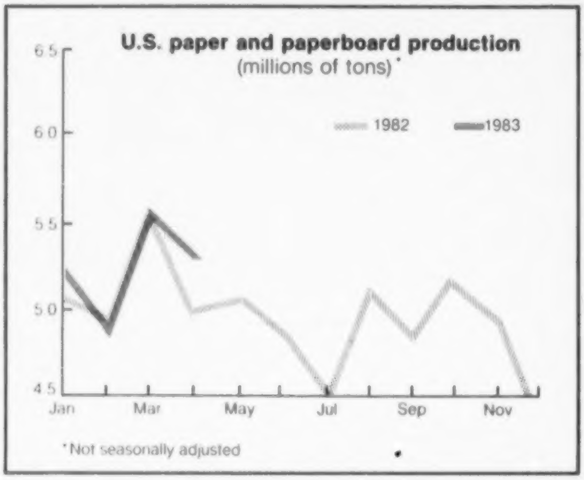
MONTH IN STATISTICS

U.S. paper and paperboard production in April totaled 5.2 million short tons, up 4.5% over year-earlier levels, according to the American Paper Institute. The March-April two-month moving average of seasonally adjusted data on paper and paperboard production was at 61.5 million tpy, and for the first four months of the year was at 61.9 million tpy.

Among major grades for the first four months of 1983, printing/writing grades were particularly strong, specifically in coated paper and uncoated free-sheet grades. Newsprint production, however, was relatively weak in April, bringing the four-month total some 3.6% below that of 1982. Production of paperboard has followed a pattern similar to that of the total industry, with the rate of production in each month of the January-April period holding within 1.4% of its average level. For the four-month period, paperboard output was 3.8% ahead of the same period in 1982.

Total Canadian newsprint shipments totaled 712,000 metric tons in April, up 1.0% from a year ago, according to the Canadian Pulp & Paper Assn. Newsprint mill operating rates were 82% in April, compared with 84% in April 1982.



U.S. paper and paperboard production (millions of tons)*

*Not seasonally adjusted

		Latest month (000 short tons)	% change from year ago	Annualized year-to-date (000 short tons)	% change from year ago
PAPER & PAPERBOARD PRODUCTION[1]					
Newsprint	April	400	−8.5	5,127	−3.6
Uncoated groundwood (s)	April	127	3.3	1,404	−0.3
Coated paper (s)	April	431	5.4	5,276	7.4
Uncoated free sheet (s)	April	738	11.3	8,626	8.1
Unbleached kraft packaging and industrial (s)	April	290	−0.3	3,723	−3.4
Tissue	April	385	7.5	4,627	3.4
Total paper	**April**	**2,635**	**4.4**	**31,904**	**2.9**
Kraft linerboard, unbleached	April	1,233	6.5	14,526	5.9
Semichemical medium	April	385	4.1	4,522	0.9
Bleached paperboard	April	330	4.4	3,878	2.4
Recycled paperboard	April	569	1.6	6,975	4.1
Total paperboard	**April**	**2,607**	**4.7**	**30,915**	**3.8**
Total paper and paperboard*	**April**	**5,242**	**4.5**	**62,819**	**3.3**
PULP, WASTEPAPER & FIBER[2]					
Total woodpulp production	March	4,572	−0.5	51,465	0.4
Market pulp production	March	577	7.6	6,038	1.2
Wastepaper consumption at paper/board mills	March	1,251	1.3	14,136	4.2
Pulpwood consumption (cords)	April	7,360	4.9	84,504	6.0
CONVERTED PRODUCTS STATISTICS[3]					
Corrugated box shipments (billion ft²)	April	20.466	2.6	81.052†	2.9
Containerboard inventories at box plants	Apr. 1	2,414	−6.1		
INTERNATIONAL TRADE[2]					
U.S. paper imports (including products)	March	736	4.8	7,654	−1.7
Imports of Canadian newsprint	March	612	1.5	6,042†	−7.2
U.S. paper exports (including products)	March	348	−13.4	4,244	3.7
Exports of unbleached kraft linerboard	April	184	21.1	2,149	10.8
Exports of woodpulp	March	332	4.1	3,139	−1.6
CANADIAN STATISTICS[4] (reported in metric tons)					
Total newsprint shipments	April	712	1.0	2,597†	−7.7
Operating rates	April	82%	84%	82%	92%
Inventories held by U.S. consumers	Apr. 30	1,234	−24.3		
Woodpulp shipments (export only)	April	1,415	−1.5	5,892†	−5.1
Operating rates	April	72%	77%	79%	85%

1. American Paper Institute. 2. API, Bureau of Census, American Pulpwood Assn. 3. Fiber Box Assn., Paperboard Packaging Council. 4. Canadian Pulp & Paper Assn.
*Includes construction and wet machine grades. †Not annualized. ‡Not directly comparable to year ago because of coding change. (s) = shipments

LABOR

Negotiations begin in B.C.

Labor talks began in British Columbia on May 31 with the Canadian Paperworkers Union and the Pulp & Paperworkers of Canada, while the International Woodworkers of America started negotiating on June 2.

Both sides appeared to be far apart in their goals for negotiations this year, but sat down to the bargaining table with similiar attitudes concerning restoring the economic health of the industry.

Art Gruntman, CPU vice president for western Canada, said the union does not expect to get the generous settlement negotiated in 1981. That contract, which expires June 30, gave wage increases of 15% in the first year and 13% in the second, boosting the hourly base pay to C$11.46 in 1981 and C$12.96 in 1982.

Western Canadian workers' wages are significantly ahead of their eastern Canadian counterparts, who began earning C$12.52 in base hourly pay following a 10% hike effective May 1. Wage rates of West Coast U.S. workers are also high, averaging US$11.05 last year, while those in the South were only U.S.$8.56, with most first-year settlements this year in the 6% to 7% range (see table).

British Columbia employers, who are represented by the Pulp & Paper Industrial Relations Bureau and by the Forest Industrial Relations Ltd., are seeking a three-year contract with no cost increase in the first year.

The Canadian Paperworkers Union wants a one-year contract with a 12% pay hike and a four-hour reduction in the work week, as well as improvements in the pension plan and other benefits.

As talks began in May, both sides appeared adamant about at least two of the issues. Neither side wanted to change its proposal for the length of the agreement, and the CPU refused to consider the companies' request that employees be given the option of working during at least part of their vacations.

If a one-year term is approved, West Coast contracts will expire two months after the present agreements covering most of the industry in eastern Canada.

Pulp and paper industry base wage rates by region

	Canada		United States	
Year	B.C.	Eastern	South	West
1983	—	C$12.52	—	—
1982	C$12.96	11.38	$8.56	$11.05
1981	11.46	10.16	7.91	9.37
1980	9.96	9.23	7.28	8.53
1979	9.06	7.89	6.74	7.90
1978	8.16	7.46	6.13	7.25
1977	7.61	6.99	5.57	6.59
1976	6.89	6.47	5.04	5.96
1975	6.14	5.88	4.58	5.26
1974	5.10	4.57	4.15	4.78
1973	4.45	4.21	3.78	4.32
1972	4.09	3.85	3.48	4.02
1971	3.80	3.51	3.28	3.76
1970	3.50	3.25	3.09	3.45

Source: P&P Factbook, 1982-83

Strike ends at Scott Maritimes

Canadian Paperworkers Union members on strike at Scott Maritimes Ltd.'s pulp mill in Abercrombie Point, N.S., since Sept. 10, 1982, have ratified a new two-year contract. The 630-tpd bleached kraft mill, idle during the 37-week walkout, was expected to start up the first week in June.

The new agreement calls for wage increases of 12%/10% and improvements in the pension plan and other benefits. In addition, it allows the company greater flexibility in scheduling overtime and restarting the mill after shutdowns, said a union spokesman. The company declined to comment.

The union struck because Scott wanted to take back some of the gains made by the union in the old contract, an observer said. Although the company did get greater leverage in some areas, the union considered the new pension plan a "good breakthrough," and the wage settlement is in line with others in the industry, a union executive said.

The new contract was approved in voting on May 30, 18 days after workers turned down the offer by a vote of three to one. Observers said employees were persuaded to settle the strike after the company decided to prepare the mill for an "extended shutdown" and to indefinitely delay completion of a C$51.7-million modernization.

- United Paperworkers International Union workers at **James River Corp.**'s Ashland, Wis., mill and nearby converting operations were expected to reject the company's latest labor contract offer and vote to serve a required six-day strike notice, said a company executive. No further talks between the two sides had been set.
- **Procter & Gamble Products** has reached a new three-year labor agreement with 1,532 UPIU employees at the company's Green Bay, Wis., mill. The contract, which expires Apr. 30, 1986, calls for pay hikes of 6% each year.

UPIU to fight IP's labor tactics

Claiming International Paper Co. has had a "hostile and antagonistic approach" in its relations with the United Paperworkers International Union, the union plans to change that relationship, according to UPIU president Wayne Glenn.

In a union publication, Glenn said, "The UPIU Corporate Campaign will hold IP and all its supporters accountable for the deterioration of labor relations we now experience."

The union is compiling a list of all businesses in any way associated with IP, including investigating the affiliations of the company's directors, and is asking its members for suggestions on how to coerce IP into meeting its goals.

The goals of the union are to get IP to negotiate contracts promptly, to remain neutral when workers attempt to organize unions at IP's mills, and to handle worker grievances effectively and "foster an atmosphere conducive to meaningful negotiations," said the news item.

IP chairman Dr. Edwin A. Gee remarked at the annual company meeting that the company's labor policy is based on three principles: treating all its workers "fairly and with respect," recognizing "the right of all our employees to join a union or represent themselves" and following "normal legal requirements" in its labor relations.

Recycled paperboard:

Market improves slowly; starts with low grades

Statistics:	**1981**	**1982**	**1983e**
Production, 000 tons[1]	7,001	6,476	6,975
Capacity, 000 tons	8,593	8,731	8,920
Utilization rate, %	82.3	74.2	78.2
Imports, 000 tons	30	32	47
Exports, 000 tons	174	149	140
Apparent U.S. consumption			
000 tons	6,926	6,508	7,022
lb/capita	60.3	56.2	56.4
000 tons/$ billion real GNP (1972)	4.59	4.40	4.64

[1] American Paper Institute data

Grade structure: Recycled paperboard usually consists entirely of wastepaper and is produced on both fourdrinier and multi-ply paper machines. Grades are generally divided into three categories: folding boxboard, setup boxboard, and paperboard. Most folding boxboard is clay-coated, while setup boxboard is uncoated. Recycled paperboard includes corrugating medium, linerboard, gypsum linerboard, and core, can and tube stock but not any construction papers or boards.

Production/capacity: Production declined 7.5%, to 6.48 million tons in 1982 from 7.0 million tons in 1981.

Discounting was rife in the market last year as producers attempted to maintain orders while demand deteriorated in line with the lag in the general economy worldwide.

Clay-coated paperboard consumption, however, reportedly gained some folding carton market share at the expense of solid bleached sulfate paperboard as customers downgraded to lower costs. But demand for chipboard and other lower recycled grades was weak, keeping down the market overall.

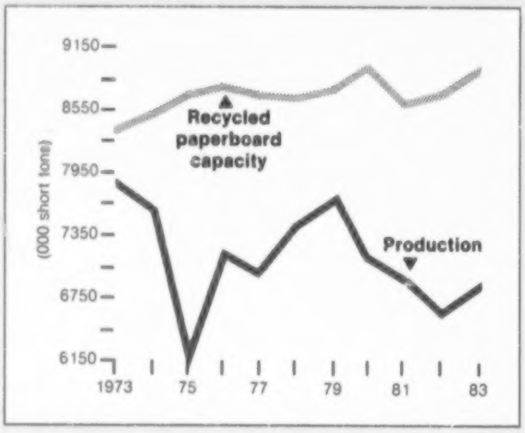
Exports of recycled paperboard were off 14%, to 149,000 tons in 1982 from 174,000 tons in 1981—consistent with the decline that began at the start of the decade.

Recycled paperboard capacity, also declining in recent years, is now on the way up. Expansions totalling 418,000 tons and representing an average annual increase of 1.6%, will raise total capacity to 8.6 million tons in 1982 and to 9.1 million tons in 1985. In the past 12 years, 2.5 million tons of capacity has been eliminated, although most of it has been offset by incremental expansion of existing machines.

Whippany Paper Board Co.'s recycled mills in Whippany and Clifton, N.J., have remained idle since the company declared bankruptcy in 1980, but the Whippany site could be sold this year if Container Corp. of America exercises its option—which expires Jan. 1, 1984—to buy that mill.

Outlook: Recycled paperboard markets began to improve in the second quarter with the lower grades being bolstered by a pickup in construction. Recycled production in 1983 is expected to reach 6.98 million tons, 5.3% higher than last year. Operating rates should rise to 78%, vs 74% in 1982.

Prices for the lower grades such as chipboard and whitelined vat began to firm toward midyear, with several companies announcing price increases that appeared to be gaining widespread customer acceptance. Clay-coated markets, however, remained depressed and were not expected to rebound until the last quarter of 1983.



Estimated capacities of major U.S. companies are:

	Annual capacity (000 tons)	**Capacity share** (%)
1. Container Corp. of America	753	8.4
2. Sonoco Products Co.	555	6.2
3. Jefferson Smurfit	500[1]	5.6
4. Whippany Paper Board Co.[2]	454	—
5. National Gypsum Co.	417	4.7
6. U.S. Gypsum Co.	347	3.9
7. Caraustar Industries[3]	325	3.6
8. Packaging Corp. of America	318	3.6
9. Newark Group	300	3.4
10. St. Regis Paper Co.	295	3.3
11. Federal Paper Board Co.	281	3.1
12. Rock-Tenn Co.	210	2.3

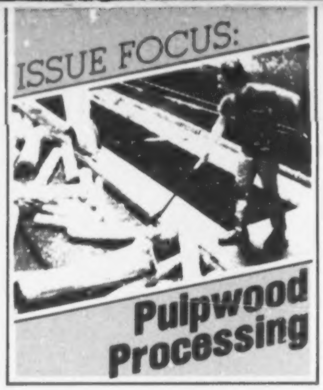
U.S. capacity (1983): **8.920 million tons**
Capacity share of top five companies: 32.2%
Capacity share of top ten companies: 49.9%

[1] Includes Alton Packaging and Diamond-Smurfit.
[2] Two of the company's mills in Clinton and Whippany, N.J., have remained closed since Whippany declared bankruptcy in 1980. Container Corp. of America has an option to buy Whippany's Eden mill in Whippany, however.
[3] Holding company with ownership in Austell Box Board, Sweetwater Paper Board, Carolina Paper Board, and Carotell Paper Board.
[4] Excluding Whippany.

Pricing: Clay-coated 20-pt folding boxboard (rolls) price history in $/short ton (year-end) is: 1975, $257; 1976, $262; 1977, $284; 1978, $305; 1979, $355; 1980, $400; 1981, $425; 1982, $340-380*; June 1983, $340-380*.

Bending 20-pt chipboard (rolls) in $/short ton (year-end) is: 1975, $204; 1976, $212; 1977, $219; 1978, $225; 1979, $260; 1980, $275; 1981, $280; 1982, $240-280*; June 1983, $280. (*Indicates the estimated regular transaction prices after discounting has occurred.)

Markets: Approximate market demand for the various recycled paperboard grades as measured by their capacity share is as follows: folding boxboard, 29.7%; setup boxboard, 3.7%; corrugating medium, 16.5%; gypsum linerboard, 14.3%; linerboard, 6.5%; container chipboard and filler board, 3.5%; other paperboard, 25.7%.



Growth rate of Southern forests to rise further through year 2000

Recent rapid increases in forest growth are due to events such as abandonment of farmland and soil bank plantings in the late 1950s

By ROBERT W. HAGLER

■ In the past 10 to 15 years, forestland owners, foresters, and industry managers alike have watched forest growth rates over much of the southern U.S. accelerate at a phenomenal pace. From 1969 to 1979, the net annual growth of timber in northeastern Florida increased from an average of 39 ft^3/acre/year to 63 ft^3/acre/year. The entire state of Virginia increased its rate of forest growth per acre by more than 50% between 1966 and 1977, while southeastern Georgia increased its growth per acre from 56 ft^3 to 77 ft^3 during the 1970s.

Under sustained yield management, these increases have cleared the way for substantially higher levels of forest utilization. As unexpected as these increases in growth have been, they have proven necessary to support the tremendous expansion of southern capacity in the pulp and paper and solid wood products industries that has taken place over the same period. In fact, Arthur D. Little Inc. estimates the overall softwood growth/removal ratio in the South dropped only marginally between 1970 and 1980. The question is: can we expect this historical trend to continue and, if so, how far will it go? This article is intended to create an understanding of the historical events leading to this supply situation, analyze current events, and project what the future may hold for the southern timber supply.

WHAT HAPPENED? The reasons behind the tremendous increases in growth rates in the last few years lie, in part, in the way the U.S. Forest Service estimates annual growth. Forest resources are surveyed in the South approximately every 10 years (although surveys may be less frequent in the future because of recent reductions in operating budgets). Permanent plots are remeasured during the survey time, and estimates of commercial forestland characteristics are made based on statistical sampling procedures. Timber growth is usually estimated using this system of periodically remeasuring such permanent sampling plots. However, only trees greater than 5.0 in. dbh (diameter breast height) are measured. In an area where a large volume of stems becomes merchantable (more than 5.7 in. dbh) between two surveys, the reported growth in that area will show a substantial increase in both volume/acre and growth/acre. Growth rates, therefore, have a tendency to increase in large steps as a result of large slugs of ingrowth in a particular region as young trees attain the required size.

Consequently, it is not the increased concern for the environment, private landowner assistance programs, capital gains tax incentives, or government reforestation efforts during the 1970s that led to the dramatic increases in growth rates previously mentioned. It was the result of events in the 1950s and early 1960s that led to reforestation of vast areas (primarily with softwood) which then became merchantable during recent decades. These events deserve a closer look.

EVENTS OF THE PAST. By far the most important source of additional forestland and growing stock that has appeared in the South in the past 30 years is abandoned farmland. This demographic event began in earnest after World War II, as the general population migrated to urban areas and old fields began to naturally reseed to predominantly pioneer stands of loblolly and shortleaf pine. At its peak, up to 3 million acres/year were being taken out of agricultural production and the process of natural succession back to forest was begun. If only half of this land seeded to pine (a conservative estimate considering geographic location and soil condition), an additional 1.5 million acres/year of relatively even-aged pine stands would have been established.

The event of farmland abandonment began to subside in the late 1950s, and by about 1965 had begun to reverse itself. Since then, the South has annually lost commercial forestland to higher value-added alternative uses such as urbanization and agriculture. This trend is expected to continue through the rest of this century.

The second major event to take place during this period was the Soil Bank Reforestation Program between 1956 and 1963. In these seven years, more than 2 million acres of generally unproductive land were planted with

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Mr. Hagler is with Arthur D. Little Inc., Cambridge, Mass.

pine seedlings. Many more acres were artificially reseeded. Although the major thrust of the program was soil stabilization, its primary legacy was the establishment of millions of acres of pine forests that would materially affect the competitive situation of the region's forest products industry nearly two decades later. It is interesting that forest industry planting and seeding activities in the South increased substantially over this period, from about 120,000 acres annually in 1950 to nearly 550,000 acres in 1961. A major lull in reforestation efforts occurred at this point, and not until 1970 did the industry again top the 550,000-acre mark.

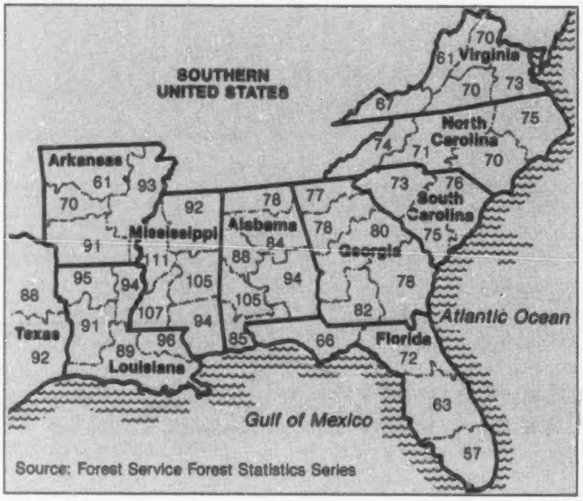
Before 1965, softwood stand establishment components included farmland abandonment; public and forest industry activities; and Soil Bank plantings by nonindustrial private owners (NIPOs), which had a substantial effect. By the early 1960s, the importance of these components had shuffled to the point where forest industry activity had become the predominant method of pine stand establishment. NIPO planting and seeding activities dropped to much lower levels than in prior years, while pine establishment on public lands remained fairly constant throughout. The drop in stand establishment that began in the early 1960s may have a dramatic impact on the availability of softwood timber through the 1980s and 1990s. It has already begun to show up in recent U.S. Forest Service survey counts of the number of 2- and 4-in. trees. These are down in recent surveys in Florida (1980) and southern Georgia (1981), by roughly 20% and 46%, respectively.

WHAT DOES THE FUTURE HOLD? The forces behind increased growth rates in recent years are clearly evident. At the same time, new questions arise. Will the trend toward higher growth rates continue? Could statewide growth rates in excess of 100 ft³/acre/year be seen by the next set of forest surveys? In general, the answer is no.

The natural potential for timber growth is far from evenly distributed in the southern states. Figure 1 shows the weighted growth potential per acre in each of 43 survey units derived from U.S. Forest Service site classification data. Such data are a valuable tool when used to compare the potential productivity of state and regional areas. As might be expected, growth potential is lower in mountain and upland areas than in the more ideally suited regions of Alabama and Mississippi. Since this growth potential is based on fully stocked natural stands, areas that are heavily planted to plantations may actually exceed these growth potential estimates by as much as 10%. Throughout the entire South, however, the average growth was estimated in 1980 to be about 83% of the overall natural growth potential.

"Natural growth potential" defines a practical limit on the increasing growth rates seen in recent years. In particular survey units, such as the piedmont of South Carolina and southwestern Georgia, this limit has already been reached and further increases in growth will be minimal. Many survey units, however, such as northwestern Florida and the southern coastal plain of North Carolina, have considerable room for improvement. Some areas may never reach their maximum growth potential because of ownership patterns and lack of forest management. Clearly, the potential for increased forest growth and utilization is site-specific. Accuracy of projections is diluted as wider regions are considered and local considerations such as the economical accessibility of timber growth are ignored. Still, a survey unit analysis supports the conclusion that some parts of the South have far more unutilized potential than others.

FIGURE 1: **Weighted natural forest growth potential of southern survey units** (ft³/acre/year)



Source: Forest Service Forest Statistics Series

Having established that there is a practical limit to forest growth—already reached in some parts of the South—the question remains: what does the future hold for growth rates in the South? Forest growth projections in a given area can be estimated with reasonable confidence after careful consideration of four key factors:

1. Changes in the commercial forestland base due to agriculture, urbanization, etc.
2. Changes in the growth rate of trees as genetically improved first- and second-generation superior trees are planted and increase yields.
3. Changes in the growth/acre ratio between hardwood and softwood as many unmanaged stands revert to hardwood because of failure to replant softwood, selective harvesting, and lack of natural fire. At the same time, industry-owned lands continue to be converted from natural mixed stands to pine plantations.
4. Changes in growth/acre as inventories build up toward full stocking because of a continued surplus of growth above removals in many areas.

Growth/acre (softwood and hardwood) averaged about 67 ft³/acre/year over the entire South in 1980. This is projected to increase to nearly 80 ft³/acre/year by the year 2000. However, because of a smaller commercial forestland base (5% to 10% smaller by the year 2000) only marginal additional growth will be available in the South for utilization and subsequent new facility construction and expansion.

Supply of forest resources for utilization in the wood products industry is primarily a function of history. The South owes much of its recent gains in growth and stocking levels to events of the 1950s and '60s. Counterproductive trends and a lack of similar events during the late 1960s and '70s will result in only marginal increases in softwood growth through the end of this century. While broad regional comparisons are valid, estimates of future available supply in any one area must consider local characteristics such as geography, species mix, ownership, stand size and accessibility, growth rates, and locally unique wood demand characteristics. ■

TABLE 1: **Total wastepaper recovered by grade—1970 to 2000 (000 short tons)**

Year	Total[1] wastepaper recovered	Grade of wastepaper recovered				
		Mixed	News	Corrugated	Pulp[2] substitutes	High-grade[2] deinking
1970	12,562	2,749	2,445	4,235	2,282	851
1975	13,072	2,822	2,416	5,083	1,949	803
1980	18,051	2,862	3,359	8,062	2,450	1,318
1985	20,735	3,230	3,775	9,520	2,620	1,590
1990	23,960	3,505	4,350	11,305	2,835	1,965
2000	30,590	4,020	5,465	15,370	3,220	2,515

[1] Total wastepaper recovered is the sum of wastepaper used in the paper industry, other uses, and exports less imports.
[2] Pulp substitutes and high-grade deinking prior to 1976 were allocated by Franklin Associates Ltd. on the basis of 1976 data; prior to that the American Paper Institute data combined the two categories.

Source: Franklin Associates Ltd.

TABLE 3: **Estimated wastepaper exports by country of destination—1985 and 1990**

Major export markets	1980	1981	1985e	1990e
South Korea	407,800	518,200	542,800	666,600
Taiwan (China)	370,200	386,100	428,600	454,800
Japan	201,400	84,000	181,300	201,400
Canada	450,800	356,500	464,400	488,000
Mexico	588,500	346,000	701,710	820,300
Italy	199,300	114,100	219,200	239,200
Venezuela	166,300	128,700	104,700	93,000
Other countries	329,400	278,900	418,800	421,700
Total	2,644,300	2,212,500	3,061,510	3,485,600

Source: Franklin Associates Ltd.

Wastepaper consumption to rise

Global expansion of paper industry, along with anticipated startup of numerous resource recovery plants, will pressure wastepaper supply

By DEBRA A. ADAMS, News Editor

■ Consumption of wastepaper will increase during the 1980s and 1990s because of greater demand from domestic mills as well as from foreign countries where paper industries are growing, according to study done recently by Franklin Associates Ltd. for the American Paper Institute. Recyclable paper supplies, meanwhile, could be threatened by municipal waste-to-energy resource recovery plants starting up in the U.S. during this time.

More secondary fiber and proportionally less virgin pulp will be used in the next 20 years as a result of worldwide pulp capacity not keeping pace with demand, according to the study, *Waste Paper—the Future of a Resource, 1980-2000.*

Moreover, growth in the lumber industry is expected to be only slight, or even flat, due to the reduced housing activity anticipated for the next two decades. This will reduce the amount of wood residues available for pulping and put additional strains on recyclable paper, the study notes.

WASTEPAPER USAGE TO INCREASE. Use of wastepaper as a raw material in domestic mills increased 29% during the 1970s, with corrugated box plant cuttings and old corrugated containers being the dominant grade consumed. This trend is expected to continue, although Franklin Associates sees paperboard mills actually consuming slightly less recyclable fiber until 1990 and then beginning to gradually increase orders to reach only the 1970 level by the year 2000.

The forecast for pulp substitutes and high-grade deinking grades indicates only a slight increase in U.S. consumption during the next two decades. Use of wastepaper in newsprint and tissue grades should continue to rise but at a slower pace than in the 1970s. More old newspapers will be used as a result of more deinking mills being built, and tissue mills are expected to consume 2.75 million tons of wastepaper in 2000 compared to 1.7 million tons in 1980.

U.S. WILL REMAIN MAJOR MARKET. U.S. wastepaper exports are expected to increase to 4.45 million short tons by 2000, from 2.644 tons in 1980, with Mexico and Korea being major consumers. Considerable fluctuations could occur in various countries' buying patterns during this time, but the impact on the overall market is expected to be minimal as variations are likely to offset each other, according to the report.

Foreign countries are likely to continue to depend on the U.S. as their major source of wastepaper in the next two decades since demand usually grows faster than recyclable paper can be generated, the study notes. Expansions of recovery systems also may be impractical for these countries. In addition, containerized shipping and favorable freight rates will continue to make U.S. wastepaper prices attractive on many heavily traveled routes.

Higher domestic wastepaper recovery rates will be required to keep up with increased export demand. Nationally, the recovery rate is expected to rise to 28.7% by 2000, from 26.3% in 1980. The greatest growth in recov-

ISSUE FOCUS:
Recycling

TABLE 2: **Wastepaper utilization in total paper, paperboard, and construction paper—1970 to 2000 (000 short tons)**

	Grade of wastepaper utilized					Total wastepaper utilized	
Year	Mixed	News	Corrugated	Pulp[1] substitutes	High-grade[1] deinking	Tons	%
1970	2,639	2,235	4,080	2,216	851	12,021	23.2
1975	2,605	2,040	4,744	1,792	803	11,983	23.4
1980	2,268	2,564	6,866	2,254	1,142	15,094	23.7
1985	2,400	2,905	8,220	2,420	1,410	17,355	23.6
1990	2,555	3,420	9,825	2,605	1,755	20,160	24.4
2000	2,780	4,385	13,490	2,920	2,245	25,820	24.9

[1] Pulp substitutes and high-grade deinking prior to 1976 were allocated by Franklin Associates Ltd. on the basis of 1976 data; prior to that the American Paper Institute data combined the two categories.

Source: 1970 to 1980 data from API; 1985 to 2000 data from Franklin Associates Ltd.

TABLE 4: **Fibrous materials used in the paper industry—1950 to 2000 (%)**

Year	Roundwood	Wood residues	Total woodpulp	Wastepaper	Other fibers
1950	60	4	64	31	5
1960	59	13	72	25	3
1970	55	22	77	21	2
1980	46	30	76	23	1
1990	44	32	76	23	1
2000	43	32	75	24	1

Source: Franklin Associates Ltd.

worldwide through year 2000

ery rates is slated to occur in old newspapers and old corrugated containers.

Recovery of old newspapers will rise to between 31% and 40%, or 5.5 to 7 million tons in 2000, from 28.5%, or 3.3 million tons in 1980. The recovery rate for corrugated could rise so high it could depress prices in some areas by 2000, when it is projected to rise to between 47% and 50%, or 12.3 to 14.6 million tons, from 40%, or 6.3 million tons in 1980.

TYPE OF FURNISH SWINGS. The amount of wastepaper recycled in the U.S. will outpace total paper production in the mid- to late-1980s, Franklin Associates reported. The utilization rate is expected to increase to between 23.7% and 26.5%, or 25.8 to 28.8 million tons, by 2000 from 22.8%, or 15.1 million tons, in 1980. ,

Wastepaper will comprise approximately 23.7% of the raw materials used to produce an estimated 108.9 million tons of paper and paperboard in the U.S. by 2000, compared with 22.8% of the fiber furnish used to make 66.1 million tons in 1980, the study indicates. In the same period, woodpulp as a percentage of furnish will drop to 75.3% from 76% and use of other fibers will remain at about 1%.

Old corrugated containers will remain the predominant grade of secondary fiber consumed, increasing to 13.5 million tons in 2000 from 6.9 million tons in 1980. Old newspaper demand will rise to 4.4 million tons from 2.6 million tons. Orders for pulp substitutes and deinking grades will not increase as rapidly.

MILLS TO USE MORE CORRUGATED. Recycled paperboard mills have traditionally consumed a tremendous amount of wastepaper, particularly corrugated, but flat or slow growth in this segment should not put much pressure on wastepaper supplies in the next two decades. Mills are expected to buy 9.9 million tons of wastepaper by 2000, compared with 7.7 million tons in 1980.

Corrugated used in unbleached kraft paperboard production during the 1970s increased just 4% to 6% but is forecast to grow to 16% by 2000. Large mills, particularly those in the South, have found that using corrugated is a cost-effective way to increase their output. Research on the use of corrugated continues and could result in even higher demand for corrugated from this segment of the industry, according to Franklin Associates.

Semichemical paperboard mills are expected to increase their use of wastepaper to 25% by 2000 from 20% in 1980, with a swing toward more corrugated and less box plant cuttings as mills install more sophisticated cleaning equipment.

Old newspaper consumption will be spurred by an increase in the number of deinking mills, according to the study. By 2000 it is estimated that there will be 10 or 11 newsprint machines producing deinked newsprint and numerous virgin fiber mills using supplemental furnish for producing newsprint.

Currently, four mills make deinked newsprint from old newspapers and two mills use a significant amount of deinked news with virgin fiber in making newsprint. The percentage of old news used in domestic production is forecast to rise to 25% in 2000 from 19.2% in 1980.

MUNICIPAL COMPETITION. Wastepaper represents an estimated half of the energy value in residential and commercial waste. About 200 communities are considering building resource recovery plants to dispose of solid waste. It is uncertain how feasible these facilities

TABLE 5: **Disposition of paper in U.S. solid waste—2000 (000 tons)**

Category	Wastepaper generated[1]	Diverted or destroyed[2]	Net wastepaper[3]	Uncollected[4]	Available for recovery or disposal[5]	Source separated and recovered[6] 10^3 tons	Source separated and recovered[6] % of available	Energy recovery[7] 10^3 tons	Energy recovery[7] % of available	Collected and disposed[8] 10^3 tons	Collected and disposed[8] % of available
Old newspapers	17,588	88	17,500	3,145	14,355	5,100	35.5	1,740	12.1	7,515	52.4
Old corrugated containers	27,800	0	27,800	5,000	22,800	11,400	50.0	1,970	8.6	9,430	41.4
All other paper and paperboard	49,062	13,727	35,335	6,355	28,980	3,840	13.3	5,280	18.2	19,860	68.5
Total paper and paperboard	94,450	13,815	80,635	14,500	66,135	20,340	30.8	8,990	13.6	36,805	55.6

1. Paper, paperboard, and other products after residential or commercial end-use. Does not include converting scrap.
2. Disposed into sewer system, stored in libraries, used in buildings, or otherwise diverted from recovery or disposal.
3. Paper not destroyed or permanently diverted.
4. Estimated amount which is self-disposed (e.g., on farms, by commercial establishments), littered, or otherwise does not go into the waste stream collected and disposed in an organized system.
5. The paper waste which could be presorted before being discarcded, recovered from the waste stream, or disposed of.
6. Paper recovered by individuals, groups, and public or private collectors for recycling. Does not include converting scrap.
7. Does not include energy recovery on-premise by private organizations.
8. Disposal would most commonly be landfill, but could be incineration without energy recovery.

Source: Franklin Associates, Ltd.

would be to operate, considering five were closed in 1982. But, the more that are opened, the greater will be the competition among private and public sources for a share of recyclable paper supplies.

Problems were already encountered in Akron, Ohio. A case is now being fought in federal court to decide whether that city has the right to require that all garbage be dumped at the resource recovery plant. This landmark case will likely affect the rights of private haulers to have access to the solid waste stream in the future.

This concern among recyclers that municipal waste-to-energy plants could monopolize the solid waste stream is somewhat allayed in the report. Franklin Associates forecasts that energy recovery plants will process about 15.5 million tons of solid waste in 1990 and 29 million tons by 2000. This is not expected to cause problems nationally, but competition in some areas could result in shortages of some grades. ■

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Pulp mill soda ash use stable in 1983

By **BARRY SHOCKETT**

Domestic demand in the U.S. for soda ash, or sodium carbonate (Na_2CO_3), has been near the 8.3-million-ton mark since 1979, but in 1982 dropped to about 7.86 million short tons. In conjunction with increased capacity, this has forced producers to look for other markets to develop. These include the use of Na_2CO_3 to reduce coal-fired-boiler SO_2 emissions and acid rain neutralization. Both of these markets, however, require time to develop. The area of export sales also has significant potential, as shown by an increase in exports to Japan in early 1983.

In the first two months of 1983, 52,500 tons were shipped to Japan compared with 32,000 tons for 1982. Soda ash demand in Canada also dropped in 1982, since the glass, chemical, and paper industries all had decreased sales.

U.S. statistics, sodium carbonate (000 short tons)

	1979	1980	1981r	1982e
Capacity	10,100	9,620	10,360	10,540
Production	8,253	8,275	8,281	7,862.5
Imports	40	18.3	11.8	18
Exports	997	1,094	1,050.5	1,108.5
Apparent consumption*	7,306	7,131.5	7,146.5	6,676.5
Glass**	3,995	3,780	3,790	3,538.5
Chemicals	1,686	1,426.5	1,420	1,400
Pulping	252	250	250	233.5
Other†	1,373	1,675	1,718	1,505

*Includes inventory adjustments.
**Including containers, sheet and fibers.
†Including water treatment, detergents, and miscellaneous.
Source U.S. Bureau of Mines; Bureau of Census, Dept. of Commerce.

Canadian statistics, sodium carbonate (000 short tons)

	1979	1980	1981	1982e
Capacity	441	441	441	441
Production	410	423	419	419
Imports	202	178	153	134.5
Exports	39	18	11.8	18
Apparent consumption*	582	566	589	530
Glass, including fibers	336	346	361.5	321.5
Chemicals	85	87	89	88.5
Pulping	49.5	18.5	22.5	21
Miscellaneous†	112.5	114.5	116	99

*Includes inventory changes.
†Including mining, smelting, detergents, cleaners, and water treatment.

SODIUM CARBONATE

UNITED STATES

Uses: Primary use of soda ash in the pulp and paper industry is in preparing sulfite liquor. Kraft mills also employ soda ash for makeup liquor. The largest application is by the glass industry followed by chemical manufacturing, detergents, and water treatment.

Demand: Pulp mill soda ash demand last year dropped to about 233,500 tons, off 6.5% from the 250,000 tons consumed in 1981. Glass industry use also dropped in 1982, to about 3.5 million tons from 3.8 million in 1981. Total demand was 6.7 million tons, compared to 7.15 million tons in 1981.

Sources: The six natural soda ash producers in the U.S. are: Tenneco, Allied, FMC, Stauffer Chemical, and Texasgulf in Wyoming. Kerr-McGee mines its trona in California. Allied operates the sole synthetic plant (Solvay process) in the U.S. at Syracuse, N.Y.

Availability: With entry of a fifth trona producer at Green River, U.S. capacity is near 11,000 tpy—more than enough for domestic demand for the next few years. 1982, market; 1981, market; 1980, market; 1979, market.

Pricing: In 1982, natural soda ash saw four price drops ($2/ton each), stabilizing at $84/ton in November. Synthetic sodium carbonate prices stayed at $132/ton throughout the year. Pricing history: natural, 1982, $92-$84/ton, f.o.b. Green River; 1981, $86-$92/ton; 1980, $76-$86/ton; 1979, $61-$66/ton; synthetic, 1982, $132/ton, f.o.b. Syracuse, N.Y.; 1981, $126-$132/ton; 1980, $113-$123/ton; 1979, $96-$101/ton.

Forecast: Pulp mill usage of soda ash in 1983 is predicted to increase between 1,000-2,000 tons. No price hikes are expected for the balance of 1983.

CANADA

Uses: Sulfite mills use sodium carbonate to prepare cooking liquor, while kraft mills use it to supplement caustic in their makeup liquor. Other end-uses include glass, chemicals, mining, detergents, and water treatment.

Demand: The demand from all end-users decreased in 1982, with pulp and paper use off only 6% to 7%, or an estimated 21,000 tons.

Sources: Allied Chemical is the only domestic producer and makes synthetic ash in Ontario. It supplies customers in western Canada with trona imported from its U.S. parent.

Availability: Canadian demand surpasses capacity, but U.S. imports make up the shortfall. 1982, market; 1981, market; 1980, market; 1979, market.

Pricing: Because of falling U.S. prices the price remained constant at $183/ton for bulk shipments, f.o.b. Amherstburg. Pricing history: 1982, $183/ton; 1981, $168-$183/ton; 1980, $145-$160/ton; 1979, $108-$128/ton.

Forecast: No price hikes are foreseen during 1983 due to the depressed markets in North America. Mill usage should increase slightly this year.

Mr. Shockett is consulting editor-chemical markets for Pulp & Paper.

PULP & PAPER

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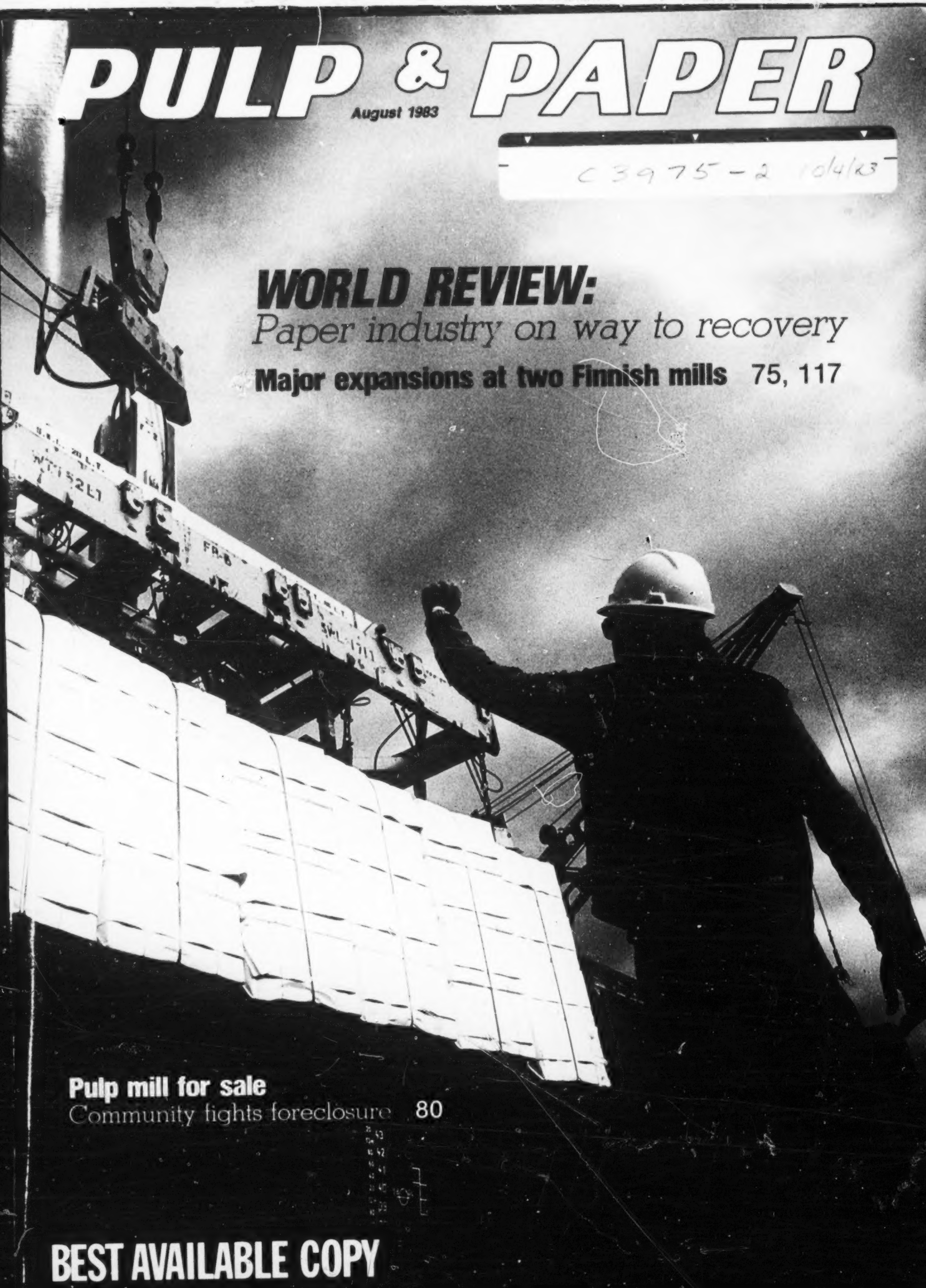

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__COVER:__ Pulp produced at three Georgia-Pacific mills being loaded on board for export to overseas markets. (Photo courtesy Georgia-Pacific.)

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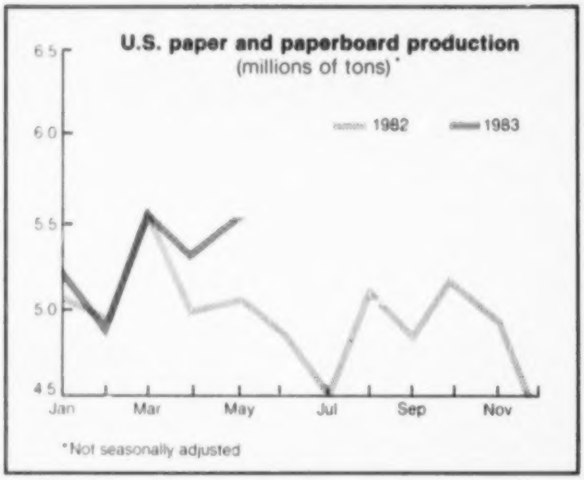
MONTH IN STATISTICS

U.S. PAPER AND PAPERBOARD PRODUCTION in May totaled 5.541 million short tons, up 10.6% over year-earlier levels, according to the American Paper Institute. The May output level was the second highest monthly total, exceeded only by the 5.595 million tons produced in March 1981. The April-May two-month moving average of seasonally adjusted data on paper and paperboard production was at 62.8 million tpy, compared with the 61.9 million tpy during January-April.

Among major grades, the strongest growth trends continued in the printing/writing paper grades, with uncoated free sheet and coated paper showing particular strength. Paperboard production in May was about 5% over year-ago rates, with major strength in containerboard production for domestic use, which gained 5.4%, and paperboard production for export, up 8.5%. The Fibre Box Assn. reported fiber box shipments in April and May moved sharply above their first-quarter levels.

Canadian newsprint shipments totaled 683,000 metric tons in May, down 4.9% from a year ago, according to the Canadian Pulp & Paper Assn. Newsprint mill operating rates were 85% in May compared with 88% a year earlier.



		Latest month (000 short tons)	% change from year ago	Annualized year-to-date (000 short tons)	% change from year ago
PAPER & PAPERBOARD PRODUCTION[1]					
Newsprint	May	440	3.8	5,159	−2.2
Uncoated groundwood (s)	May	133	14.7	1,458	3.1
Coated paper (s)	May	462	13.0	5,369	9.3
Uncoated free sheet (s)	May	733	14.7	8,634	9.2
Unbleached kraft packaging and industrial (s)	May	304	12.2	3,717	−0.4
Tissue	May	405	11.3	4,708	5.7
Total paper	**May**	**2,754**	**12.2**	**32,223**	**5.0**
Kraft linerboard, unbleached	May	1,318	11.7	14,788	7.1
Semichemical medium	May	415	9.2	4,614	2.6
Bleached paperboard	May	342	4.0	3,923	2.7
Recycled paperboard	May	617	9.2	7,063	5.2
Total paperboard	**May**	**2,787**	**9.1**	**31,428**	**4.9**
Total paper and paperboard*	**May**	**5,541**	**10.6**	**63,651**	**5.0**
PULP, WASTEPAPER & FIBER[2]					
Total woodpulp production	April	4,280	1.7	51,419	0.7
Market pulp production	April	537	8.7	6,140	2.1
Wastepaper consumption at paper/board mills	April	1,164	0.6	14,094	3.8
Pulpwood consumption (cords)	May	7,162	5.5	84,864	5.9
CONVERTED PRODUCTS STATISTICS[3]					
Corrugated box shipments (billion ft^2)	May	20.777	10.7	101.829†	4.4
Containerboard inventories at box plants	May 1	2,495	−6.1		
INTERNATIONAL TRADE[2]					
U.S. paper imports (including products)	April	699	16.5	8,185	4.9
Imports of Canadian newsprint	April	527	5.4	6,337†	−4.3
U.S. paper exports (including products)	April	392	14.3	4,412	6.4
Exports of unbleached kraft linerboard	May	203	12.2	2,207	10.6
Exports of woodpulp	April	346	9.5	3,548	2.0
CANADIAN STATISTICS[4] (reported in metric tons)					
Total newsprint shipments	May	683	−4.9	3,280†	−7.1
Operating rates	May	85%	88%	82%	91%
Inventories held by U.S. consumers	May 31	1,182	−26.1		
Woodpulp shipments (export only)	May	526	2.3	2,573†	4.1
Operating rates	May	79%	81%	79%	85%

1. American Paper Institute. 2. API, Bureau of Census, American Pulpwood Assn. 3. Fiber Box Assn., Paperboard Packaging Council. 4. Canadian Pulp & Paper Assn.
*Includes construction and wet machine grades. †Not annualized. ‡Not directly comparable to year ago because of coding change. (s) = shipments.

CFI completes boiler conversion

Two power boilers at Continental Forest Industries Inc.'s Augusta, Ga., bleached board mill have been converted to multifuel boilers, the company announced. As a result of the $30-million project, Nos. 1 and 2 boilers will burn about 250,000 tpy of coal, saving the equivalent of 1 million bbl/year of oil. Both boilers could still burn oil or gas.

The new coal-handling system, completely enclosed, has four coal silos, each with a 1,600-tpd capacity, constructed by First Colony. Coal-firing equipment was supplied by Babcock & Wilcox, original manufacturers of the boiler.

SHUTDOWN

Durham closes recycled liner mill

Durham Mills Inc. has indefinitely idled its Durham, Pa., 375-tpd recycled linerboard mill due to "substantial losses." But the mill, which closed effective June 18, is expected to come back online within one to six months depending on the company's success in finding additional investors and improvement in markets.

Heavy financial losses were incurred as a result of "rapid escalation of wastepaper prices which we were unable to cover in the sales price," the company noted. Earlier this year Durham appointed Perry H. Koplik & Sons Inc. as agent to market the mill's "Metro-Linerboard" (basis weights 38 and 42 lb) to the northeast corrugated box industry.

Partners in the Durham mill purchased last year from bankrupt Whippany Paper Board include: Connecticut Container Corp. of North Haven, Conn.; Star Corrugated Box Co. of Maspeth, N.Y.; and Greater New York Box, of Clifton, N.J.

CAPITAL SPENDING

1983 capital spending up in U.S.

Betting on continued recovery in the economy, U.S. papermakers are still planning a slight increase in 1983 capital spending, despite the fact that profits are just beginning to revive. The latest Commerce Dept. survey shows that the industry expects to lift outlays for new plant and equipment by 1.0% to $6.03 billion in 1983, while a recent McGraw-Hill survey reports that the paper industry is planning an even stronger 6.3% increase in outlays to $6.34 billion. This would reverse a two-year decline in which spending fell from a 1980 peak of $6.8 billion to $5.97 billion last year.

But faced with a slow recovery in export markets, overcapacity in newsprint and heavy debt loads, Canadian producers plan to reduce capital spending by 41.8% in 1983 to C$1.07 billion, according to a Statistics Canada survey completed early this year. This would follow a 16.1% drop last year to $1.83 billion from the 1981 peak of $2.18 billion.

U.S. spending pickup. According to the Commerce survey, U.S. paper industry spending is expected to decline from a seasonally adjusted annual rate of $6.02 billion in the first quarter of 1983 to a low in the second quarter of $5.84 billion, and then jump to $6.10 billion in the third and $6.17 billion in the fourth quarter. Actual spending for 1983 could turn out higher since plans are normally revised upward as an economic recovery gathers steam.

In contrast to the slight rise in paper industry capital spending, U.S. business as a whole plans to reduce outlays by 3.4% in 1983, after a 1.6% decline in 1982. The decline in real spending would be somewhat less since capital goods prices are expected to decline 0.4% this year.

Major projects. Overall U.S. paper industry spending levels are being helped by several major projects—new greenfield mills being built by Great Northern Nekoosa and Union Camp Corp. and International Paper's modernization of its Georgetown, S.C., mill. IP plans to boost spending by 62% this year, while increases of around 35% are planned by GNN and Union Camp. Also buoying spending totals are continued heavy outlays on projects to reduce energy costs, such as multifuel boilers to replace older oil-and-gas-fired units. In addition, environmental spending is expected to rise sharply in 1983, reversing a declining trend.

According to McGraw-Hill's survey, U.S. paper industry spending this year will be divided equally between "expansion" and "replacement/modernization." About 89% of outlays will go for machinery and equipment, 9% for buildings and 2% for motor vehicles.

(Continued on p. 33)

Complete listings of mill downtime taken in 1982 and in the first and second quarters of 1983 are now available for purchase. The reports list facilities alphabetically and by company and grade categories. *Pulp & Paper* does not guarantee the accuracy or completeness of the reports, which can be purchased for $45 for the 1982 report, and $15 for each of the quarterly reports. For listings, send a check payable to *Pulp & Paper*, 500 Howard St., San Francisco, Calif., 94105.

North American paper industry capital spending estimates for 1983
(billions of $)

United States	**1983e**	**1982**	**1981**	**% change 1983/82**
Commerce Dept (Apr./May)[1]				
Paper & allied	$6.03	$5.97	$6.72	+1.0%
All manufacturing	112.79	119.68	126.79	−5.8
McGraw-Hill (Mar./Apr.)				
Paper & Pulp[2]	6.34	5.97	6.72	+6.3
All manufacturing	117.74	119.68	126.79	−1.6
Canada				
Statistics Canada (Dec./Jan.)				
Paper & allied[1]	C$1.07	C$1.83	C$2.18	−41.8
All manufacturing[1]	9.10	11.12	12.74	−18.2

[1] When survey conducted.
[2] Excludes repair expenditures.

The survey reports preliminary paper industry capital spending plans of $5.4 billion in 1984 and $7.0 billion in 1985. The 15% decline next year from 1983's level may reflect completion of major projects but will probably prove low if the recovery continues. The Commerce survey found that the industry planned to boost outlays for new plant and equipment to abate pollution by 43% to $430 million from $300 million in 1982. McGraw-Hill's survey showed that the industry was planning an even sharper 75.7% boost in pollution control spending to $550 million from $313 million in 1982.

Canadian slump. The size of the decline in Canadian paper industry capital spending was not unexpected, given the poor profit performance of most companies, particularly in western Canada. Outlays this year are expected to drop 72.6% to C$120.2 million in British Columbia, 44.0% to C$314.6 million in Ontario and 20.9% to C$365.1 million in Quebec.

Of total Canadian paper industry capital spending of C$1.06 billion, 13.5% will be for construction and 86.5% for machinery and equipment. Not included in this total is nearly C$1 billion in noncapitalized repair spending, which will be up 8.6% from a year ago.

ENVIRONMENT

API/NFPA announce awards

Winners of the industry's 10th annual environmental and energy achievement awards were announced at the American Paper Institute/National Forest Products Assn. Environmental Forum meeting June 1-3 in Washington, D.C. An independent jury of experts selected the following winners:

- **Water pollution control.** Buckeye Cellulose Corp. received this award for its new 300,000-tpy bleached kraft pulp mill at Oglethorpe, Ga., said to have the lowest biological oxygen demand (BOD) and color per ton of pulp of any mill in North America.

Use of oxygen delignification followed by three-stage D/CED bleaching results in a 30% to 35% reduction in untreated waste BOD vs a conventional kraft process. The combination of the oxygen stage and bleaching with a high level of chlorine dioxide substitution produces less than half the color of a typical bleached kraft plant. Further color reduction is achieved by adding oxygen to the extraction stage. Extensive internal recycling minimizes the water sent to treatment.

Last year effluent color averaged less than 125 lb of equivalent platinum cobalt units/ton of pulp, compared with 400 to 600 for a typical bleached kraft process. Water usage averaged 14,000 gal/ton, compared with 40,000 for a typical plant. Untreated BOD averaged 45 lb/ton with an average removal efficiency of 95%, compared with typical plant performance of 60 to 80 lb/ton with less than 90% removal. As a result, BOD at the plant averaged 2.3 lb/ton, well within Buckeye's permit limit of 5.3 lb/ton (about half the federal new source performance standard of 11.0). Suspended solids and pH were also within federal/state limits.

- **Energy innovation.** Georgia-Pacific Corp. received the award for installation of a new horizontal belt washer on a hardwood kraft pulp line at its Crossett, Ark., mill. Purpose of the project was to achieve high washing efficiency at low dilution rates, improving energy efficiency.

Compared with a conventional washer, however, the new Crossett washer has achieved the following results: (1) Weak black liquor solids have increased from 13.5% to 18.9%, reducing boiler fuel consumption 1.6 million Btu/a.d. ton of pulp—a $2-million annual natural gas savings; (2) Filtrate pulping requirements were reduced an estimated 10 kWh/ton, with an electricity cost savings of $90,000/year; (3) Increased washing efficiency reduced brownstock washer chemical losses and consequent saltcake makeup from 25 to 20 lb/ton, resulting in a $130,000/year chemical savings.

- **Air pollution control.** Crown Zellerbach Corp. earned the award for its control of nitrogen oxide emissions from a combined-cycle cogeneration system at its Antioch, Calif., recycled paperboard mill. The new system had to meet the lowest achievable emission rate requirement of 42 ppm NO_x exhaust concentration—never before achieved by a large industrial cogeneration system.

Included are a General Electric 32-MW gas turbine and a supplementally fired heat recovery steam generator. The project can produce up to 47 MW of electrical power using an existing 12-MW extraction/condensing steam turbine and supplies 260,000 lb/hour of steam. The NO_x emission control is achieved via steam injection and specially designed low NO_x combustion liners. Higher efficiency and power sales resulted in a 30% to 50% reduction in mill power cost per unit of production.

- **Energy management.** Scott Paper Co.'s S.D. Warren Div. received the award for an $85-million biomass power project completed at its Westbrook, Maine, mill in 1982. The cogeneration project includes a high-pressure boiler capable of burning both low-cost woodwaste and coal to produce 650,000 lb/hour of steam.

Replacing five older, less efficient oil-fired boilers, the project has eliminated use of over 700,000 bbl/year of imported oil and reduced energy cost per ton by 65%, restoring profitability and ensuring future operation of the 104-year-old facility. Local air quality has also improved, with sulfur dioxide and particulate emissions cut to about one-quarter of their former level.

- **Forest management.** Westvaco Corp. was the recipient of the award for a forest research program which included construction of a laboratory at its Summerville, S.C., forestry center in 1982 to research technology in forest tree improvement, biometrics, tree physiology, soils and hardwood management. Field laboratories were also added at Rupert, W.Va., and Wickliffe, Ky., for a total investment of more than $4 million. Total staff was increased to 58. Westvaco's research promises to increase future supplies of wood from the company's own land holdings and augment basic knowledge of forest biology in the eastern U.S.

- **Solid waste management.** Owens-Illinois Inc. won the award for developing an approved retrofit system of protecting groundwater quality against contamination from a long-established sludge landfill. The system at its Tomahawk, Wis., mill is based on geotechnical exploration and modeling, and makes use of a novel water flow containment plan.

Bleached paperboard:

Low capacity growth will lead to high operating rates

Statistics	**1981**	**1982**	**1983e**
Production, 000 tons	3,910	3,665	3,775
Capacity, 000 tons[1]	4,141	4,184	4,198
Utilization rate, %	94.4	87.6	89.9
Imports, 000 tons	—	—	—
Exports, 000 tons[2]	557	525	570
Apparent U.S. consumption			
000 tons	3,353	3,140	27.36
lb/capita	29.18	27.07	3,205
000 tons/$billion real GNP (1972)	2.23	2.13	2.14

1. Because of grade switching, capacity utilization is difficult to define.
2. API production for export.

Grade structure: Solid bleached sulfate (SBS) paperboard is primarily used for folding carton and milk carton stock. Smaller amounts are used for cups, plates, and trays and for linerboard. Bleached boards are made in a range of calipers, typically 10 to 28 pt, and in three levels of density—low, medium and high. About 50% of the tonnage is coated. Basis weights vary between 120 and 300 lb/3,000 ft².

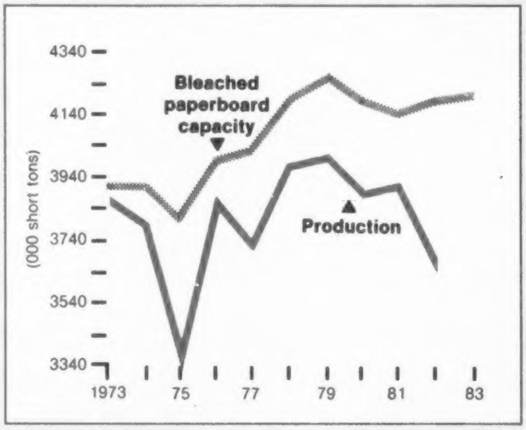
Production capacity. Bleached board production dropped sharply in 1982 by 6.3%, to 3.67 million tons after a small rise of 2.1%, to 3.91 million tons in 1981. As a result, operating rates declined from 94.4% in 1981 to 87.6% last year, their lowest level since the 1974-75 recession. Exports also dropped 10% in 1982 to 525,000 tons due to the world recession and strong U.S. dollar.

The decline in operating rates occurred last year despite the fact that capacity rose only 1% to 4.18 million tons. Industry capacity for SBS is difficult to define since some machines can produce bristols, board, and market and fluff pulps. Some capacity last year was swung into production of roll pulp and contributed to the sharp drop in bleached board production.

Outlook. Operating rates for SBS should be among the highest for any grade in the paper industry during the next several years mainly due to limited capacity growth.

Capacity is expected to remain relatively flat this year and through 1985 is expected to rise only 61,000 tons, to 4.25 million tons. International Paper Co. has plans to add about 150,000 tpy of capacity through 1985 by the reconfiguration of its Georgetown, S.C., mill, which will permit more SBS to be produced at its Texarkana, Texas, facility, and through a possible expansion of its Pine Bluff, Ark., mill. Small incremental capacity increases are planned by some other producers and some production could also be shifted from market pulp to bleached board production.

Production is projected to rise about 3% in 1983 and to average at least 2% over the next several years. Folding carton demand is expected to increase by about 2%/year, while domestic milk carton demand may be bottoming out after having declined about 5%/year in recent years due to plastic penetration in half-gallon containers and lower per capita milk consumption. Domestic demand for SBS is also expected to benefit from such new developments as ovenable board and aseptic packaging. But further plastic penetration into half-gallon-size milk cartons and food service disposables (cups, trays, plates) remains a threat.



Estimated capacities of major U.S. companies are:

	Annual capacity (000 tons)	**Capacity share** (%)
1. International Paper	950	22.6
2. Potlatch	500	11.9
3. Westvaco	410	9.8
4. Continental Forest Industries	370	8.8
5. Federal Paper Board	330	7.9
6. Temple-Eastex	310	7.4
7. Champion International	265	6.3
8. James River	209	5.0
9. Weyerhaeuser	200	4.8
10. Gulf States Paper	180	4.3
11. Container Corp. of America	170	4.0
12. Gilman Paper	160	3.8
13. Georgia-Pacific	150	3.6

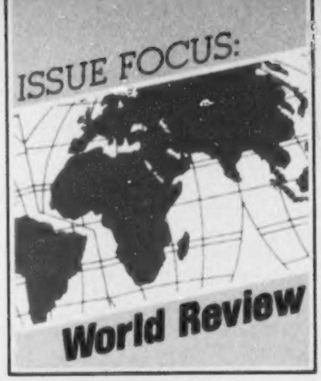
U.S. capacity (1983): **4.198 million short tons**
Capacity share of top five companies: 61.0%
Capacity share of top ten companies: 88.8%

Export shipments of SBS are expected to resume their high rate of growth, increasing demand for milk carton stock in such markets as Japan, Asia/Oceania, and Latin America.

As a result of overall growth in demand and limited capacity addition, operating rates should rise from around 90% this year to 92% to 93% in 1984, and 95% to 96% in 1985. This should permit producers to pass through price increases and improve profit margins.

Pricing: List prices for SBS folding carton stock dropped from $625/ton late last year to $590, wiping out a July 1982 price increase. The drop was due to weakening demand and increasing price competition from clay-coated recycled paperboard mills, which benefitted during the recession from a sharp decline in wastepaper costs. Several producers failed in an attempt to raise prices last spring but another move to return prices to their former list level is likely later this year.

Approximate price history for 15-pt coated SBS folding carton board in $/short ton at year-end: 1973, $250; 1974, $350; 1975, $355; 1976, $385; 1977, $405; 1978, $445; 1979, $490; 1980, $518; 1981, $625; 1982, $590; 1983e, $625.



WORLD PULP/PAPER INDUSTRY: decline in '82, but hope in '83

Output of pulp and paper decreased in 1982; markets for newsprint and pulp were especially weak; but some Asian and other nations did well

By PETER SUTTON, DAVE O'DONOGHUE, and JOHN KALISH, International Editors

■ Many countries around the world report that 1982 was a difficult year, with sluggish domestic demand and oversupplied international markets. For the first time since the slump of 1975, world paper and board production dropped below the previous year. The 1982 total was 166.5 million tons, down 2% from 1981. World pulp output fared even worse, dropping 4.2% to 123.8 million tons.

With world paper and board consumption at 165.8 million tons in 1982, down nearly 2%, few major producers escaped from falling demand. In Western Europe, only four of the 16 paper-producing countries recorded an increase in 1982 output over 1981. And none of the four was a Scandinavian country. The U.S., Canada, Brazil and New Zealand also saw output fall.

Countries in Asia and the southern hemisphere reported a more satisfactory year. Japan's paper and board production went up nearly 500,000 tons in 1982, and People's Rep. of China, India and Taiwan all had increased output. Of the five big producers in the Far East, only Rep. of Korea reported a drop in production—for the first time in that country's history. South Africa, Australia and Mexico, all making more than 1 million tpy of paper and board, also increased output in 1982. In Eastern Europe, total 1982 production showed an increase over 1981.

NEWSPRINT MILLS HIT. Industry overcapacity and the resulting low operating rates affected mills supplying the main international markets. While newsprint production in Western Europe followed the trend of recent years (down 150,000 tons in the EEC and up 100,000 tons in Scandinavia), North American—mostly Canadian—newsprint producers were hurt by the drop in demand and in prices. Around the world, mills made 1 million tons less newsprint in 1982 than in 1981.

In general, the other major paper and board markets had a marginally better year than newsprint, though for some it was a mixed result. For example, although the U.S. **linerboard** market had its severest downturn in 1982 since 1949, major European suppliers, such as the Swedes, had a good year—partly due to the high dollar-exchange rate. In Asia's linerboard markets, some nations were imposing strict import controls, but the consumer markets of Singapore and Hong Kong began to firm up during the year.

Of the other major grades, production of **printing/writing papers** held up well around the world, particularly in Asia, and ended the year at about the same level as in 1981—41.5 million tons. Reports from many countries confirm that, in general, paperboard producers had a very difficult 1982.

Following a year that many producers would like to forget, 1983 started off with signs of economic upturn in U.S., setting a generally more optimistic mood. Paper demand increased in Western Europe in the early part of the year, but by midyear the growth in demand had leveled off. Although few of the major producers expect any dramatic improvement in 1983, there is the view that paper and board markets—with the exception of newsprint—are slowly on the way up.

PULP MARKET PROBLEMS. If 1982 was a bad year for the paper mills, it was a near disaster for the pulp suppliers. The report for chemical pulp production in 1982 is nearly 4 million tons below 1981. In round figures, Scandinavia produced 1 million tons less, and North America 3 million tons less. Average operating rate of the Norscan market pulp mills, the main suppliers to the world, dropped 10.5 points from 1981 down to 76.7%. The trend of falling world prices and of paper mills trimming pulp stocks to a minimum continued through 1982.

The poor pulp market accentuated the buying trend toward the cheaper hardwood market pulps and away

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** In this review, data from all countries, including U.S., are reported in metric tons. All data conform with FAO definitions: thus, paper/board totals do not include insulation board; pulp figures exclude screenings, defibrated, and exploded pulps.*

Production by continents, world total (000 metric tons)

PULP	1960	1970	1980	1981	1982
North America	32,964	54,912	65,969	66,496	61,774
Europe	20,965	34,853	40,235	39,945	38,577
Asia/Australasia	5,156	14,268	18,239	16,404	16,611
Latin America	821	2,224	5,848	5,166	5,162
Africa	124	900	1,502	1,648	1,698
World total	**60,031**	**107,157**	**131,793**	**129,659**	**123,822**

PAPER AND PAPERBOARD	1960	1970	1980	1981	1982
North America	38,917	58,914	70,225	70,098	66,539
Europe	25,634	45,159	59,023	59,140	58,217
Asia/Australasia	7,861	20,621	31,962	31,137	32,332
Latin America	1,656	3,712	7,737	7,583	7,582
Africa	288	892	1,717	1,843	1,848
World total	**74,355**	**129,298**	**170,664**	**169,801**	**166,518**

World's top 20 producing and consuming countries

PAPER AND BOARD PRODUCTION (000 tons)

	1982	1981
1. USA	54,132	56,495
2. Japan	17,452	16,980
3. Canada	12,406	13,603
4. USSR	9,077	8,955
5. Germany, Fed. Rep.	7,779	7,828
6. Sweden	5,928	6,136
7. Finland	5,895	6,135
8. China	5,890	5,400
9. France	5,127	5,148
10. Italy	4,571	4,852
11. Brazil	3,244	3,297
12. UK	3,124	3,379
13. Spain	2,685	2,588
14. Mexico	1,987	1,950
15. Korea, Rep.	1,737	1,783
16. Austria	1,707	1,671
17. Netherlands	1,633	1,683
18. Taiwan	1,556	1,498
19. Australia	1,496	1,394
20. Norway	1,304	1,373

PULP PRODUCTION (000 tons)

	1982	1981
1. USA	44,786	47,211
2. Canada	16,988	19,285
3. USSR	9,160	9,060
4. Japan	8,626	8,612
5. Sweden	7,706	8,529
6. Finland	6,714	7,331
7. China	4,582	4,310
8. Brazil	2,912	2,910
9. Germany, Fed. Rep.	2,004	2,021
10. France	1,765	1,715
11. Norway	1,522	1,608
12. Spain	1,350	1,354
13. Austria	1,189	1,210
14. South Africa	1,165	1,122
15 New Zealand	1,060	1,160
16. Czechoslovakia	960	880
17. Portugal	952	895
18. Italy	816	962
19. Romania	815	815
20. Mexico	748	743

PER CAPITA CONSUMPTION (lb/year)

	1982	1981
1. USA	551	591
2. Sweden	445	441
3. Canada	386	434
4. Denmark	366	359
5. Finland	353	437
6. Switzerland	344	366
7. Germany, Fed. Rep.	335	346
8. Netherlands	335	340
9. Japan	322	315
10. Belgium	315	311
11. New Zealand	315	298
12. Australia	298	302
13. Norway	287	311
14. UK	262	273
15. France	258	254
16. Austria	229	238
17. Iceland	198	201
18. Ireland	194	205
19. Italy	192	192
20. Taiwan	192	172

REVIEW OF TOP 25 PAPER- AND PULP-PRODUCING NATIONS

Abridged data on production and export/import trade are given for countries included in the Top 20 tables for paper and board production and for pulp production.

Australia

Population: 15,170,000. Per capita consumption of paper and board: 135 kg/298 lb. Number of paper and board mills: 16. Number of pulp mills: 17 (sulfate: 1; sulfite: 1; soda: 2; semichemical: 4; mechanical: 8; nonwood: 1).

Paper/board capacity: 1,745,000e tons **Pulp capacity:** 1,000,000 tons

(000 metric tons)

	Production		**Imports**		**Exports**	
	1981	**1982**	**1981**	**1982**	**1981**	**1982**
Paper	442	548	545	432	13	14
Board	951	948	208	196	79	61
Total	**1,393**	**1,496**	**753**	**628**	**92**	**75**
Chemical woodpulp	445	479	252	241	—	—
Other pulps	218	226	2	1	—	—
Total	**663**	**705**	**254**	**242**	**—**	**—**

Austria

Population: 7,570,000. Per capita consumption of paper and board: 104 kg/229 lb. Number of paper and board mills: 36. Number of pulp mills: 21 (sulfate: 2; sulfite: 8; semichemical: 1; mechanical: 10).

Paper/board capacity: 2,006,000 tons **Pulp capacity:** 1,358,000 tons
Operating rate 1982: 85% **Operating rate 1982:** 88%

(000 metric tons)

	Production		**Imports**		**Exports**	
	1981	**1982**	**1981**	**1982**	**1981**	**1982**
Paper	935	961	111	177	610	628
Board	736	746	95	84	440	471
Total	**1,671**	**1,707**	**206**	**211**	**1,050**	**1,099**
Chemical woodpulp	861	853	186	183	250	221
Other pulps	349	336	15	18	12	12
Total	**1,210**	**1,189**	**201**	**201**	**262**	**233**

Brazil

Population: 124,000,000. Per capita consumption of paper and board: 27 kg/60 lb. Number of paper and board mills: 160. Number of pulp mills: 48.

Paper/board capacity: 4,000,000 tons **Pulp capacity:** 3,990,000 tons

(000 metric tons)

	Production		**Imports**		**Exports**	
	1981	**1982**	**1981**	**1982**	**1981**	**1982**
Paper	2,062	2,110	234	249	219	193
Board	1,228	1,134	—	—	78	54
Total	**3,290**	**3,244**	**234**	**249**	**297**	**247**
Chemical woodpulp	2,910	2,912	15	12	769	810
Other pulps	n.a.	n.a.	6	1	—	—
Total	**2,910**	**2,912**	**21**	**13**	**769**	**810**

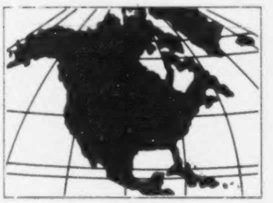
from top-price bleached softwoods. While pulp exports of the Nordic countries and North America fell in 1982, exports from Brazil and Portugal, two key hardwood pulp suppliers, increased.

Expansion/modernization projects have understandably been affected by the state of the economy. However, an additional 10.1 million metric tons of paper and board is expected to be added to worldwide capacity by 1986 in "firm" capital spending programs reported in the *PPI Capital Investment Survey 1983-86*. A further 3.9 million tons is in advanced planning stages.

Additions to pulp capacity in the 1983-86 period will total 9.4 million tons from firm projects and 2.9 million tons in advanced planning, reports the *PPI* survey.

RELIEF IN 1983. Early 1983 brought some relief to the pulp market. With an increase in paper demand pushing heavy restocking by paper mills, the first price rise of bleached softwood kraft pulp in over a year was attempted in Western Europe. By mid-1983 it had yet to be fully accepted by buyers, but it seemed likely it would eventually be successful. Suppliers to the U.S. market were content to firm up to the list price, preparing for a probable large price increase in fourth-quarter 1983. Throughout the early part of the year, the international hardwood pulp market was considerably tighter than softwood, and not only did suppliers succeed with one price increase, but some also attempted a second for the third quarter.

General consensus at midyear was that the pulp and paper industry—following the world economy—had begun to head out of the recession into a period of recovery. Opinions varied widely on the rate of this recovery, with some regions—such as Asia and Latin America—seeming likely to see more rapid growth than others.



NORTH AMERICA

IN 1982, THE NORTH American pulp and paper industry experienced a very weak year: production slumped sharply in both the U.S. and Canada, and corporate profitability suffered.

Total North American paper and board output dropped by 5.6% to 66.5 million metric tons. Canada recorded the sharper decline, down almost 9% to 12.4 million tons, as newsprint producers were caught in the crunch of heavy competition for the traditional U.S. market and general sluggishness in overseas markets.

The operating rate for **Canada**'s newsprint mills fell dramatically from 94% in 1981 to 82% in 1982, while the operating rate for all paper and board fell to 80%. For market pulp mills, the situation was even worse as operating rates fell 11 points to 77% for 1982's average.

Fortunately with the recovery now underway, both newsprint and market pulp sectors are expected to recover to an 83% operating rate in 1983, according to Canadian Pulp & Paper Assn.

Operating rates fared somewhat better in 1982 in the **U.S.**, being about five points higher for both paper/board and market pulp. In the latter case, the strength of U.S. southern pulps helped offset some of the general weakness of the recession.

Capital investment. Much of the capital spending in **Canada** is aimed at restoring competitive ability and replacing older equipment, although some additional capacity is involved in most cases. Typical is Abitibi-

Canada

Population: 24,600,000. Per capita consumption of paper and board: 175 kg/386 lb. Number of paper and board mills: 107. Number of pulp mills: 34.

Paper/board capacity: 15,269,000 tons
Operating rate 1982: —%

Pulpcapacity: 23,165,000tons
Operating rate 1982: 76%

(000 metric tons)

	Production		Imports		Exports	
	1981	**1982**	**1981**	**1982**	**1981**	**1982**
Paper	11,256	10,423	334	225	8,755	8,073
Board	2,347	1,983	111	136	440	384
Total	**13,603**	**12,406**	**445**	**361**	**9,195**	**8,457**
Chemical woodpulp	11,380	9,257	75	87	6,084	5,372
Other pulps	7,905	7,031	60	52	515	491
Total	**19,285**	**16,968**	**135**	**139**	**6,599**	**5,863**

China, People's Rep. of

Population: 1,015,410,000. Per capita consumption of paper and board: 6.3e kg/14 lb. Number of paper and board mills: 1,600e.

Paper/board capacity: 6,850,000 tons

Pulp capacity: 5,970,000 tons

(000 metric tons)

	Production		Imports		Exports	
	1981	**1982**	**1981**	**1982**	**1981**	**1982**
Paper	3,260	3,233	217	—	117	—
Board	2,140	2,657	492	—	75	—
Total	**5,400**	**5,890**	**709**	**—**	**192**	**—**
Chemical woodpulp	740	760	590	—	0	—
Other pulps	3,570	3,822	64	—	0	—
Total	**4,310**	**4,582**	**654**	**—**	**0**	**—**

Czechoslovakia

Population: 15,520,000. Per capita consumption of paper and board: 76 kg/168 lb. Number of paper and board mills: 49. Number of pulp mills: 24 (sulfate: 5; sulfite: 7; semichemical: 1; mechanical: 10; nonwood: 1).

Paper/board capacity: 1,282,000 tons
Operating rate 1982: 97%

Pulp capacity: 1,031,000 tons
Operating rate 1982: 93%

(000 metric tons)

	Production		Imports		Exports	
	1981	**1982**	**1981**	**1982**	**1981**	**1982**
Paper	687	708	48	43	112	92
Board	539	541	75	84	80	100
Total	**1,226**	**1,249**	**123**	**127**	**192**	**192**
Chemical woodpulp	645	727	84	56	9	66
Other pulps	235	233	26	29	4	3
Total	**880**	**960**	**110**	**85**	**13**	**69**

Finland

Population: 4,830,000. Per capita consumption of paper and board: 160 kg/353 lb. Number of paper and board mills: 46. Number of pulp mills: 51 (sulfate: 18; sulfite: 8; semichemical: 3; mechanical: 22).

Paper/board capacity: 7,135,000 tons

Pulp capacity: 8,550,000 tons

(000 metric tons)

	Production		Imports		Exports	
	1981	**1982**	**1981**	**1982**	**1981**	**1982**
Paper	4,618	4,444	13	14	3,694	3,664
Board	1,517	1,451	29	28	1,141	1,168
Total	**6,135**	**5,895**	**42**	**42**	**4,835**	**4,832**
Chemical woodpulp	4,545	4,103	8	10	1,494	1,278
Other pulps	2,786	2,611	28	45	191	179
Total	**7,331**	**6,714**	**36**	**55**	**1,685**	**1,457**

WORLD PULP, PAPER, AND BOARD

	Population (1,000)	Number of mills		Capacity (1,000 m tons)		Per Capita (lb)	Consumption (1,000 tons)				Production (1,000 m tons)			
							P&B		Pulp		P&B		Pulp	
EUROPE		P&B	Pulp	P&B	Pulp		1981	1982	1981	1982	1981	1982	1981	1982
Belgium	9,900	16	3	925	400	315	1,391	1,412	592	586	887	328	337	322
Denmark	5,120	6	3	318	130	366	842	850	165	154	268	279	117	111
France	54,000	172	29	5,500	2,250	258	6,231	6,292	3,212	3,115	5,148	5,127	1,715	1,765
Germany, Fed. Rep.	61,614	208	36	8,846	2,293	335	9,685	9,349	4,348	4,311	7,828	7,779	2,021	2,004
Greece	9,700	18	4	355	65	101	428	445	138e	155e	300	280	48	43
Ireland	3,200	2	0	50e	0	194.	280e	280e	45	35	40	30	0	0
Italy	57,276	450	34	5,700	1,100	192	4,994	4,884	2,419e	2,194e	4,852	4,573	962e	816e
Netherlands	14,310	35	3	1,847	150	335*	2,198	2,169	718	626	1,683	1,633	162	136
United Kingdom	55,950	103	3	3,844	192	262	6,781e	6,680	1,696e	1,493	3,379	3,124	140	141
*Calculation on basis of nine months.														
EEC	**271,070**	**1,010**	**115**	**27,385**	**6,580**	**282**	**32,830e**	**32,361**	**13,333e**	**12,889e**	**24,385**	**23,653**	**5,502**	**5,338**
Finland	4,830	46	51	7,135	8,550	353	1,342	1,105	5,682	5,312	6,135	5,895	7,331	6,714
Norway	4,107	23	27	1,745	2,000	287	548	526	1,445	1,372	1,373	1,304	1,608	1,522
Sweden	8,300	57	59	6,860	9,625	445	1,693	1,682	5,791	5,323	6,136	5,928	8,529	7,706
Scandinavia	**17,237**	**126**	**137**	**15,740**	**20,175**	**423**	**3,583**	**3,313**	**12,918**	**12,007**	**13,644**	**13,127**	**17,468**	**15,942**
Austria	7,570	36	21	2,006	1,358	229	827	819	1,149	1,157	1,671	1,707	1,210	1,189
Iceland	234	0	0	0	0	198	21	21	0	0	0	0	0	0
Malta	350	0	0	0	0	157e	25e	25e	0	0	0	0	0	0
Portugal	10,088	95	8	700	1,000	112	504	506	464	451	571	583	895	852
Spain	37,833	207	34	3,130	1,665	159	2,631	2,879	1,423	1,451	2,588	2,684*	1,364	1,360
Switzerland	6,400	29	5	1,010	325	344	1,060	1,001	549	520e	920	887	296	296e
* Increase is partly through improved collection of production figures.														
Other W. Europe	**62,475**	**367**	**68**	**6,846**	**4,348**	**186**	**5,068**	**5,251**	**3,565**	**3,579**	**5,750**	**5,861**	**3,765**	**3,797**
Total W. Europe	**350,782**	**1,503**	**320**	**49,971**	**31,103**	**258**	**41,481**	**40,925**	**30,836**	**28,255**	**43,779**	**42,641**	**26,735**	**25,077**
Albania	2,750	4	4	10e	na	11e	13e	13e	8e	8e	8e	8e	8e	8e
Bulgaria	8,929	21	na	500	280	108	452	464	343	331	344	351	222	212
Czechoslovakia	15,520	49	24	1,282	1,031	168	1,543	1,181	977	976	1,225	1,249	880	960
German Dem. Rep.	16,732	21	19	na	na	179	1,350	1,355	791	802	1,248	1,261	679	678
Hungary	10,700	10	6	na	na	141	na	643	287	287	457	462	112	105
Poland	36,400	53	21	1,382	1,030	77	1,220	1,267	na	973	1,120	1,173	710	813
Romania	22,000	20	11	870e	na	71e	684e	684e	939e	939e	805e	805e	815e	815e
USSR	270,000	84	57	10,200e	9,300e	73e	8,905	8,927e	8,336	8,486e	8,955	9,077e	9,060	9,160e
Yugoslavia	22,740	30	21	1,350	825	112	1,169	1,143	838	840	1,199	1,190	724	749
E. Europe	**405,771**	**292**	**163**	**15,594**	**12,466**	**86**	**15,336**	**15,677**	**12,569**	**13,642**	**15,361**	**15,576**	**13,210**	**13,500**
Total Europe	**756,553**	**1,795**	**483**	**65,565**	**43,569**	**186**	**56,817e**	**56,602**	**43,405e**	**41,897e**	**59,140**	**58,217**	**39,945**	**38,577**
NORTH AMERICA														
Canada	24,600	107	34	15,269	23,165	386	4,853	4,310	12,821	11,264	13,603	12,406	19,285	16,988
United States	232,000	584	193	63,683	50,966	551	60,318	57,966	47,583	45,024	56,495	54,133	47,211	44,786
! Per capita consumption of paper and board														
North America	**256,600**	**691**	**227**	**78,952**	**74,131**	**536**	**65,171**	**62,276**	**60,404**	**56,288**	**70,098**	**66,539**	**66,496**	**61,774**
ASIA														
Afghanistan	15,800	0	0	0	0	0	1e	1e	0	0	0	0	0	0
Bangladesh	91,000	7	8	163	152	2	75	84e	66	66e	70	79e	60	60e
Bahrain	4,000	0	0	0	0	17	3	3e	0	0	0	0	0	0
Bhutan	1,300	0	0	0	0	na	na	na	0	0	0	0	0	0
Brunei	2,000	0	0	0	0	11	1	1e	0	0	0	0	0	0
Burma	33,590	4	2	na	na	2	35	35e	12	17e	10	10e	12	17e
China, People's Rep.	1,015,410	1,600e	na	6,850	5,970	13e	5,917	5,900e	4,964	5,000e	5,400	4,890	4,310	4,582
Cyprus	600	0	0	0	0	191	52	52e	0	0	0	0	0	0
Hong Kong	5,200	3	0	30	0	265	534	531e	na	na	24	21e	na	na
India	663,000	175	330e	1,816	1,850	5	1,523	1,520	na	na	1,148	1,250	na	na
Indonesia	151,890	31	14	370	75	9	546	554e	206	229e	256	256e	115	139e
Iran	40,000	17	2	330	260	30	540	550e	179	179e	129	139e	100	100e
Iraq	13,000	2	2	144	90	4	65	52e	65	51e	28	15e	44	30e
Israel	4,082	4	0	155e	0	173	316	324e	63	65	127	128	0	0
Japan	118,693	593	67	22,844	12,182	322	16,797	17,345	10,205	10,313	16,980	17,453	8,612	8,627
Jordan	2,500	1	0	8	0	35	39	39	0	0	6	6	0	0
Kampuchea	8,900	0	0	0	0	2	6	6e	0	0	0	0	0	0
Korea, People's Rep.	19,000	6	2	100e	80e	11	88	88e	48	48e	80	80e	48	48e
Korea, Rep. of	39,331	170e	5	2,180e	314	93	1,640	1,660	742	671	1,783	1,737	222	235
Kuwait	1,400	1	0	24	0	117	66	75	0	5	0	5	0	0
Laos	3,800	0	0	0	0	1	1	1e	0	0	0	0	0	0
Lebanon	3,160	3	0	20e	0	53	109	109e	na	na	45	45e	0	0
Macao	3,000	0	0	0	0	81	11	11	0	0	0	0	0	0
Malaysia	14,400	13	0	75e	na	60	499	384e	4	4e	46	46e	4	4e
Mongolia	1,670	na	na	na	na	13	10	10e	2	2e	2	2e	2	2e
Nepal	14,600	1	na	2e	20e	2	10	10e	15	15e	2	2e	15	15e
Oman	900	0	0	0	0	12	5	5e	0	0	0	0	0	0
Pakistan	84,975	18	17	125	95	4	217	225	102	109	107	119	90	95
Philippines	50,700	13	11	433	348	15	431	385	179	143	325	261	154	105
Qatar	200	0	0	0	0	33	3	3e	0	0	0	0	0	0
Saudi Arabia	9,300	0	0	0	0	25	105	105e	0	0	0	0	0	0
Singapore	2,440	2	0	40e	0	148	na	na	na	na	na	na	na	na
Sri Lanka	14,800	2	2	38	26	4	66	23	28	22	24	22	20	20
Syria	8,980	3	0	6e	0	20	49	49e	0	0	3	3e	0	0
Taiwan	18,472	160	3	1,960	400	192	1,403	1,486	335	354	1,498	1,556	350*	293*
Thailand	48,975	34	8	458	220	25	527	538	169	166	394	413	69	99
Turkey	46,000	42	12	713	547	29	553	587	377	351	496	531	329	350
United Arab Emirates	9,000	0	0	0	0	na	na	na	0	0	0	0	0	0
Vietnam	52,300	55e	50e	100e	80e	11	54e	69e	56e	60e	50e	65e	31e	25e
Yemen Arab Rep.	5,400	0	0	0	0	na	na	na	0	0	0	0	0	0
Yemen Dem. Rep.	1,900	0	0	0	0	2	2	2e	0	0	0	0	0	0
**Market pulp only*														
Asia	**2,825,633**	**2,957**	**535**	**39,034**	**22,627**	**28**	**32,299**	**32,822**	**17,816**	**17,870**	**29,033**	**30,134**	**14,581**	**14,856**

na = not available, e = estimate.

Note: The per capita figure is for consumption of paper and board in 1982. Some national editors have taken other factors into consideration, such as inventory; hence, production plus imports less exports is not always the same amount as noted above.

INDUSTRY AT A GLANCE

	Population (1,000)	Number of mills		Capacity (1,000 m tons)		Per Capita (lb)	Consumption (1,000 tons)				Production (1,000 m tons)			
		P&B	Pulp	P&B	Pulp		P&B		Pulp		T&B		Pulp	
AUSTRALASIA							1981	1982	1981	1982	1981	1982	1981	1982
Australia	15,170	16	17	1,745	1,000	298	2,054	2,049	917	947	1,393	1,496	663	705
Fiji	600	0	0	0	0	31	9	9e	0	0	0	0	0	0
New Zealand	3,160	5	9	801	1,376	315	416	487	652	625	711	702	1,160	1,050
Papua New Guinea	3,600	0	0	0	0	4	6e	6e	0	0	0	0	0	0
Samoa	200	0	0	0	0	na	na	na	0	0	0	0	0	0
Australasia	**22,730**	**21**	**26**	**2,546**	**2,376**	**247**	**2,485**	**2,545**	**1,569**	**1,572**	**2,104**	**2,198**	**1,823**	**1,755**
LATIN AMERICA														
Argentina	28,500	91	18	1,020	670	64	849	817	427	502	656	732	299	390
Bahamas	240	0	0	0	0	9	1	1e	0	0	0	0	0	0
Barbados	280	0	0	0	0	55	7	7e	0	0	0	0	0	0
Belize	143e	0	0	0	0	15e	10	10e	0	0	0	0	0	0
Bolivia	5,600	2	na	na	na	7	19	19e	1	1e	1	1e	1	1e
Brazil	124,000	160	48	4,000	3,990	57	3,233	3,246	2,172	2,115	3,297	3,244	2,910	2,912
Chile	11,487	18	7	384	799	42	324	220	357	189	319	258	744	668
Colombia	28,000	26	7	509	246	35	461	461e	254	254e	369	369e	204	204e
Costa Rica	2,600	2	1	18	28	110	122	106	5	7	12	13	5	7
Cuba	10,000	9	3	150	60	51e	232	232e	80	80e	73	73e	32	32e
Dominican Rep	5,551	2	0	45e	0	26	65	65e	4	4e	9	[illegible]	0	0
Ecuador	8,380	9	5	62	32	24	94	99	44	48	54	[illegible]	24	26
El Salvador	5,500	3	0	40	0	31	46	52e	0	3	18	22	0	0
Guatemala	7,500	4	0	48	0	35	93	88e	30	5	48	43	0	0
Guyana	900e	0	0	0	0	17e	7	7e	0	0	0	0	0	0
Haiti	5,800	0	0	0	0	2e	6	6e	0	0	0	0	0	0
Honduras	4,000	0	0	0	0	36	70	65e	0	0	0	0	0	0
Jamaica	2,215	1	0	12e	0	46	46	46e	0	0	10	10e	0	0
Mexico	77,000	62	26	2,804	1,023	64	2,519	2,268	865	876	1,950	1,987	743	748
Neth Antilles	247e	0	0	0	0	27e	3	3e	0	0	0	0	0	0
Nicaragua	2,200	0	0	0	0	25	30	25e	0	0	0	0	0	0
Panama	2,100	3	0	28	0	90	78	80	0	0	18	21	0	0
Paraguay	3,117	3	0	na	0	18	26	26e	15e	15e	13	13	15e	15e
Peru	18,500	11	4	351	311	24	228e	197	154	110	197	145	103	75
Surinam	355	0	0	0	0	93e	14	15e	0	0	0	0	0	0
Trinidad/Tobago	1,200	0	0	0	0	57e	31	31e	0	0	0	0	0	0
Uruguay	2,900	12	5	60	28	37	71	49	30	28	51	43	23	21
Venezuela	16,459	12	3	650e	160	104e	728	780	233	233	488	540	63	63
Latin America	**374,774**	**430**	**127**	**10,181**	**7,347**	**53**	**9,413**	**9,021**	**4,671**	**4,470**	**7,583**	**7,582**	**5,166**	**5,162**
AFRICA														
Algeria	20,000	6	3	155	107	24	70	81	31	na	95	100	31	31e
Angola	7,080	3	1	40e	44e	9	28e	28e	33e	33e	14e	14e	35e	35e
Benin	3,600	0	0	0	0	2	3	3e	0	0	0	0	0	0
Botswana	830	0	0	0	0	2	1	1e	0	0	0	0	0	0
Burundi	4,500	0	0	0	0	2	4e	4e	0	0	0	0	0	0
Cameroon	8,500	na	1	na	120	7	34e	29e	0	0	5e	5e	110e	100e
Central African Rep	2,290	0	0	0	0	1	1	1e	0	0	0	0	0	0
Chad	4,500	0	0	0	0	1	2	2e	0	0	0	0	0	0
Congo	1,550	0	0	0	0	2	1	1e	0	0	0	0	0	0
Egypt	42,300	15	3	170	80	13	320	270	71	73	136	133	39	44
Ethiopia	33,000	2	0	10e	0	2	17	17e	4	3e	7	5e	4	3e
Gabon	600	0	0	0	0	7	2	2e	0	0	0	0	0	0
Gambia	600	0	0	0	0	7	2e	2e	0	0	0	0	0	0
Ghana	11,750	0	0	0	0	1	2	3e	0	0	0	0	0	0
Guinea	5,300	0	0	0	0	2	4e	4e	0	0	0	0	0	0
Ivory Coast	8,000	0	0	0	0	10	35	35e	0	0	0	0	0	0
Kenya	17,000	4	na	66e	45e	9	68e	75e	0	10e	48e	55e	20e	30e
Lesotho	1,350	0	0	0	0	2	1e	1e	0	0	0	0	0	0
Liberia	1,870	0	0	0	0	5	4	4e	0	0	0	0	0	0
Libya	3,000	2	0	10e	0	11	16e	16e	0	0	6e	6e	0	0
Madagascar	9,000	1	2	28	5	7	10	9	5	6	10	9	5	6
Malawi	6,000	0	0	0	0	3	9	8e	0	0	0	0	0	0
Mali	6,900	0	0	0	0	0	1	1e	0	0	0	0	0	0
Mauritania	1,650	0	0	0	0	5	4e	4e	0	0	0	0	0	0
Mauritius	1,000	0	0	0	0	11	5	5e	0	0	0	0	0	0
Morocco	21,000	8	1	120	100	18	161	174	50	na	99	104	81	69
Mozambique	10,500	2	na	10e	na	4	23	23e	na	na	3	3e	na	na
Niger	5,350	0	0	0	0	0	1e	1e	0	0	0	0	0	0
Nigeria	85,000	3	3	14	na	4	141	144	5	na	14	14	0	0
Rwanda	5,000	0	0	0	0	1	2	2e	0	0	0	0	0	0
Senegal	5,660	0	0	0	0	4	23	23e	0	0	0	0	0	0
Sierra Leone	3,500	0	0	0	0	1	2e	2e	0	0	0	0	0	0
Somalia	3,700	0	0	0	0	1	1e	1e	0	0	0	0	0	0
South Africa	24,000	16	10	1,320	1,190	121	1,325	1,281	1,044	989e	1,288	1,301	1,122	1,165
Sudan	28,300	3	0	na	0	2	13e	13e	3e	3e	3e	3e	0	0
Swaziland	605	0	1	0	175	4	1	1	2	1	0	0	159	170
Tanzania	17,500	1	0	4	0	2	23e	23e	0	0	3	3	0	0
Togo	2,600	0	0	0	0	5	6	6e	0	0	0	0	0	0
Tunisia	6,300	5	1	34	24	22	69	75	10	8	36	29	22	18
Uganda	13,250	1	0	3e	0	2	7e	7e	0	0	2e	2e	0	0
Upper Volta	6,900	0	0	0	0	1	2e	2e	0	0	0	0	0	0
Zaire	28,100	1	0	na	0	1	9e	9e	0	0	1e	1e	0	0
Zambia	6,100	1	1	16	14e	1	33	33e	0	7	16	16e	0	7e
Zimbabwe	7,500	3	1	550e	25e	24	86e	74e	26e	26e	57e	45e	20e	20e
Africa	**483,035**	**77**	**28**	**2,250**	**1,924**	**12**	**2,572**	**2,500**	**1,284**	**1,159**	**1,843**	**1,848**	**1,648**	**1,698**
WORLD TOTAL	**4,519,325**	**5,971**	**1,426**	**198,528**	**151,974**	**82**	**168,757**	**165,768**	**130,497**	**124,604**	**169,809**	**166,518**	**130,902**	**125,065**

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Price's new newsprint machine at Iroquois Falls, Ont., which replaces four older units.

Investment has slowed somewhat in the **U.S.** as well. American Paper Institute has forecast a 1.7%/year increase in paper and board capacity through 1985.

The first half of 1983 has been generally positive, and the consensus is that a sustained economic recovery is underway with real GNP expected to rise by 3% in the U.S. The recovery of export markets may be somewhat slower, particularly in view of increased competition from relatively new suppliers such as Brazil in market pulp and South Africa in newsprint.

EUROPE

THE LONG-AWAITED recovery never really materialized in 1982, as the Western European economies stagnated in recession most of the year. Only toward the end of the year was a slight upturn noted, fueled largely by the start of the recovery in the U.S. European unemployment continued at high levels—actually rising through the year in many countries—and austerity measures were put into effect by many governments.

The effect of the devaluations, particularly those in the **Nordic countries**, has been to shift the competitive production cost advantage from North America back to these countries for market pulp and, to some extent, for linerboard and other grades. This has interesting implications for the European market in 1984, when the last remaining tariff barriers for paper/board imports from Nordic countries into the EEC will have been removed.

Production of paper and board in **Western Europe** dropped by almost 1 million metric tons in 1982, to about 42.7 million tons, while output of pulp (both chemical and mechanical) fell even more sharply—by over 2 million tons, or 9.2%, to 25.1 million tons. This heavy dropoff largely reflects the cutback in market pulp production in the Nordic countries.

Output in **Eastern Europe**, including **Yugoslavia**, recorded a modest increase for paper and board—up about 1.3% to 15.6 million tons. **U.S.S.R.**, **Czechoslovakia**, **Poland**, and **Dem. Rep. Germany** all reported production increases. Total Eastern European pulp output also rose, up by 2.2% to 13.5 million tons. The completion of major investments in Czechoslovakia, Poland, and U.S.S.R. should assure continued capacity and production increases for 1983 and 1984.

Upturn in Britain? The recent recession provoked the closure of many mills in Europe, particularly within EEC, and quite a few took place in 1982. Hardest Most heavily hit by closures during the past few years has been the U.K., and the continuing decline in paper/ and board production—to just under 3.2 million tons in 1982—reflects the British industry's retrenchment to a core of viable operations.

However, according to some observers, the bottom may have been reached in the U.K. and a turnaround of at least modest proportions could be underway. Of major importance is the restart, in mid-1983, of the former Bowater Ellesmere Port newsprint mill under the new ownership of Consolidated-Bathurst of Canada. By end-1983 this operation should be producing about 275,000 tpy of newsprint. Further, the Finnish producer, United Paper Mills Ltd., early this year announced plans for a new newsprint mill in northern Wales, due to start up in

France

Population: 54,000,000. Per capital consumption of paper and board: 115 kg/258 lb. Number of paper and board mills: 172. Number of pulp mills: 29 (sulfate: 8; sulfite: 4; semichemical: 7; mechanical: 16).

Paper/board capacity: 5,500,000 tons **Pulp capacity:** 2,250,000 tons

(000 metric tons)

	Production		Imports		Exports	
	1981	**1982**	**1981**	**1982**	**1981**	**1982**
Paper	3,170	3,180	1,425	1,425	844	821
Board	1,978	1,947	749	809	245	245
Total	**5,148**	**5,127**	**2,174**	**2,234**	**1,089**	**1,066**
Chemical woodpulp	1,301	1,342	1,585	1,461	149	167
Other pulps	414	423	66	58	4	2
Total	**1,715**	**1,765**	**1,651**	**1,519**	**153**	**169**

Fed. Rep. of Germany

Population: 61,614,000. Per capita consumption of paper and board: 152 kg/335 lb. Number of paper and board mills: 208. Number of pulp mills: 36 (sulfite: 11; semichemical: 1; mechanical: 24).

Paper/board capacity: 8,846,000 tons **Pulp capacity:** 2,293,000 tons
Operating rate 1982: 88% **Operating rate 1982:** 87%

(000 metric tons)

	Production		Imports		Exports	
	1981	**1982**	**1981**	**1982**	**1981**	**1982**
Paper	5,141	5,119	2,608	2,486	1,296	1,389
Board	2,687	2,660	1,124	1,086	646	679
Total	**7,828**	**7,779**	**3,732**	**3,572**	**1,942**	**2,068**
Chemical woodpulp	811	792	2,344	2,341	111	96
Other pulps	1,210	1,212	80	64	—	—
Total	**2,021**	**2,004**	**2,424**	**,2,405**	**111**	**96**

Italy

Population: 56,276,000. Per capita consumption of paper and board: 87 kg/191 lb. Number of paper and board mills: 450. Number of pulp mills: 34 (sulfite: 2; semichemical: 5; mechanical: 17; nonwood: 10).

Paper/board capacity: 5,700,000 tons **Pulp capacity:** 1,100,000 tons
Operating rate 1982: 80% **Operating rate 1982:** 74%

(000 metric tons)

	Production		Imports		Exports	
	1981	**1982**	**1981**	**1982**	**1981**	**1982**
Paper	2,869	2,572	621	672	650	618
Board	1,983	1,999	342	428	170	170
Total	**4,852**	**4,571**	**963**	**1,100**	**820**	**788**
Chemical woodpulp	189	188	1,529	1,269	12	19
Other pulps	773	628	72	90	—	—
Total	**962**	**816**	**1,601**	**1,359**	**12**	**19**

Japan

Population: 118,693,000. Per capita consumption of paper and board: 146 kg/322 lb. Number of paper and board mills: 593. Number of pulp mills: 67 (sulfate: 37; sulfite: 3; semichemical: 12; mechanical: 24; nonwood: 1).

Paper/board capacity: 22,844,000 tons **Pulpcapacity:** 12,182,000tons
Operating rate 1982: 76% **Operating rate 1982:** 71%

(000 metric tons)

	Production		Imports		Exports	
	1981	**1982**	**1981**	**1982**	**1981**	**1982**
Paper	9,944	10,353	223	351	359	411
Board	7,037	7,099	265	278	314	329
Total	**16,981**	**17,452**	**488**	**629**	**673**	**740**
Chemical woodpulp	6,272	6,508	1,176	1,274	103	66
Other pulps	2,339	2,118	522	479	1	3
Total	**8,611**	**8,626**	**—**	**1,753**	**104**	**69**

1985 and to produce 160,000 tpy.

Fed. Rep. Germany is the largest paper producer in Western Europe. Despite a slight drop in 1982 output to 7.8 million tons, FRG increased its lead over **Sweden** (5.93 million tons) in second place and **Finland** (5.90 million tons) in third place. Preliminary statistics indicate FRG output should top the 8-million-ton mark this year for a new record.

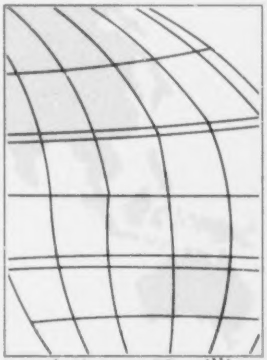
International trade issues. The EEC investigation of an alleged pulp supply cartel, which began last year, resulted in issuance of a recommendation in April 1983 that, among other things, called for pricing of market pulp in either the producer's or the buyer's currency. This suggestion has met strong opposition from many producers and major pulp buyers, and by end-June there had been no formal resolution of the issue. EEC authorities had offered, as part of the package, to drop their anticartel investigation if the new pricing arrangement were put into effect.

Also on the international trade front, the last step in phaseout of customs duties on paper and board into the EEC from EFTA countries, set for January 1984, has led to critical negotiations on the duty-free quota ceilings for Canadian newsprint. The outcome is of vital importance to the future of the hard-pressed eastern Canadian newsprint industry.

Cautious optimism. The general mood in the European industry today is one of cautious optimism that the current recovery will be maintained during the rest of 1983 and 1984. The sharp pickup in volume during the early part of 1983 has slowed somewhat, and price development has not been as rapid as had originally been hoped, due in part to the effects of the currency realignments. As a result, overall profitability will not be very satisfactory in continental Europe. The Nordic producers, however, stand to benefit from their countries' devaluations, and interim profit figures already are quite attractive for many companies.

The rate of capital investment in new production capacity appears to have slowed. According to a recent survey (*PPI*'s "Capital Investment Survey 1983-86"), about 2.9 million tons of new paper/board capacity will be added by end-1986 from "confirmed" projects, with another 700,000 tons in projects "in advanced planning stage." This represents a decline of around 10% in the "confirmed" tonnage reported last year for the 1982-85 period, and more than a 50% falloff in the "advanced planning stage" category.

Corresponding figures for new pulp capacity are 2.5 million tons for Europe in all project categories in the 1983 survey, compared to 1982's almost 3.3 million tons.



ASIA/ AUSTRALASIA

DESPITE GENERALLY depressing reports on paper industry performance in 1982 from many countries, **Asia**'s paper and board production was just over 30 million metric tons, a rise of 4% from 1981 levels. Pulp output also registered an increase (a

Korea

Population: 39,331,000. Per capita consumption of paper and board: 42 kg/ 93 lb. Number of paper and board mills: 170e. Number of pulp mills: 5 (sulfate: 1; mechanical: 4)

Paper/board capacity: 2,180,000e tons
Operating rate 1982: 83%

Pulp capacity: 314,000 tons
Operating rate 1982: 77%

(000 metric tons)

	Production		Imports		Exports	
	1981	**1982**	**1981**	**1982**	**1981**	**1982**
Paper	899	893	22	25	105	70
Board	885	844	13	12	76	45
Total	**1,784**	**1,737**	**35**	**37**	**181**	**115**
Chemical woodpulp	85	108	447	377	—	—
Other pulps	137	127	74	59	—	—
Total	**222**	**235**	**521**	**436**	**—**	**—**

Mexico

Population: 77,000,000e. Per capita consumption of paper and board: 29 kg/ 64 lb. Number of paper and board mills: 62. Number of pulp mills: 26 (sulfate: 11; sulfite: 1; mechanical: 1; nonwood: 13).

Paper/board capacity: 2,804,000 tons
Operating rate 1982: 71%

Pulp capacity: 1,022,500 tons
Operating rate 1982: 73%

(000 metric tons)

	Production		Imports		Exports	
	1981	**1982**	**1981**	**1982**	**1981**	**1982**
Paper	1,075	1,123	461	208	—	—
Board	875	864	108	73	—	—
Total	**1,950**	**1,987**	**569**	**281**	**—**	**—**
Chemical woodpulp	408	400	76	75	—	—
Other pulps	335	348	46	53	—	—
Total	**743**	**748**	**122**	**128**	**—**	**—**

Netherlands

Population: 14,310,000. Per capita consumption of paper and board: 152 kg/ 335 lb. Number of paper and board mills: 35. Number of pulp mills: 3 (mechanical: 2; nonwood: 1).

Paper/board capacity: 1,847,000 tons
Operating rate 1982: 88%

Pulp capacity: 150,000 tons
Operating rate 1982: 91%

(000 metric tons)

	Production		Imports		Exports	
	1981	**1982**	**1981**	**1982**	**1981**	**1982**
Paper	863	801	945	921	484	447
Board	820	832	450	465	396	403
Total	**1,683**	**1,633**	**1,395**	**1,386**	**880**	**850**
Chemical woodpulp	—	—	515	n.a.	3	n.a.
Other pulps	162	136	50	n.a.	1	n.a.
Total	**162**	**136**	**560**	**499**	**4**	**9**

New Zealand

Population: 3,160,000. Per capita consumption of paper and board: 143 kg/ 315 lb. Number of paper and board mills: 5. Number of pulp mills: 6 (sulfate: 2; semichemical: 2; mechanical: 5).

Paper/board capacity: 801,290 tons
Operating rate 1982: 88%

Pulp capacity: 1,375,576 tons
Operating rate 1982: 76%

(000 metric tons)

	Production		Imports		Exports	
	1981	**1982**	**1981**	**1982**	**1981**	**1982**
Paper	510	478	41	46	315	222
Board	210	224	—	—	21	38
Total	**701**	**702**	**41**	**46**	**336**	**260**
Chemical woodpulp	619	587	6	15	245	227
Other pulps	541	473	—	1	269	214
Total	**1,160**	**1,060**	**6**	**16**	**514**	**441**

modest 1.9%) to reach 14.9 million tons. Global economic recession was most frequently blamed for an increase in paper imports—which were often sold at prices undercutting domestic paper—and for sluggish investment in new projects.

Four of the five countries producing more than 1 million tpy of paper and board reported increased output in 1982: **Japan**, up 2.8% to 17.5 million tons; **People's Rep. of China**, up 9% to 5.89 million tons; **India**, up nearly 9% to 1.25 million tons; **Taiwan**, up 4% to 1.56 million tons. But **Rep. of Korea**, for the first time in the industry's history, recorded a drop in annual output, down 2.6% to 1.74 million tons. This was largely due to bankruptcies of several paper producers. The survivors, due to reduced overall capacity, generally had a more successful year than in 1981.

Japan's rebuilding continues. The long process of reorganization of the **Japanese** paper industry continued in 1982. It centers on reducing overcapacity and countering the pressure of imports (paper and board imports, mostly newsprint, increased by nearly 30% in 1982). Several key company mergers also took place in 1982. The need for reorganization was emphasized by the Ministry of International Trade & Industry when it revised downward its forecast for average annual growth in demand for 1981-90, from 3.5% to 2.5%.

Several "firsts" were announced during 1982. These included the first paper production in **Kuwait**, with startup of the Gulf Paper mill (5,000 tons of tissue and other papers). In the **Philippines**, Menzi Development Corp. plans to build the first banknote/security papers line in the ASEAN countries. In **Malaysia**, the first twin-wire tissue machine in Southeast Asia is being installed by Scott Paper's local subsidiary.

Project realism. One result of the recession is a much tighter control on capital investment by Asian governments and companies alike, with the result that although the number of proposed projects has fallen overall, those which remain are more certain of realization.

Indonesia is going ahead with two kraft paper and board mills, one of which has a World Bank loan. Georgia-Pacific of the U.S. has a 25% interest in the other. Also, a 200,000-tpy newsprint mill is due for 1984 startup in east Java.

The **Malaysian** government appears to have decided to favor just one of the two major projects which had been proposed for the country. It is expected to go ahead with an integrated mill in Kelantan rather than the 150,000-tpy integrated printing/writing mill in Sabah.

People's Rep. of China plans at least 12 major expansions at paper mills, most of them firm projects scheduled for startup in 1984-85. The Chinese industry was in contact in 1982 with major machinery and computer-control suppliers. Also, a delegation from the Chinese pulp and paper industry visited Canada and Latin America during the year, looking at possible investment opportunities.

Turkey's paper industry should see no fewer than seven mill expansion programs completed in 1983-84, three of them at tissue mills.

Australasia. The drop in demand, both domestic and overseas, in 1982 plus competition from cheap imports affected output and shipments in both **Australia** and **New Zealand**. Total paper and board production for the two countries was 2.2 million tons, up 4.5% from 1981, but pulp output dropped to 1.76 million tons, down 3.7%. This was mainly due to the 28% drop in New Zealand's market pulp production. New Zealand's paper and board output also declined marginally and included a 10% drop in newsprint and wrapping paper grades.

Australia's paper industry fared better in 1982, with newsprint output increasing by 50% following the 1981

Norway

Population: 4,107,000. Per capita consumption of paper and board: 130 kg/287 lb. Number of paper and board mills: 23. Number of pulp mills: 27 (sulfate: 2; sulfite: 4; semichemical: 2; mechanical: 19; nonwood: 4).

Paper/board capacity: 1,745,000 tons
Operating rate 1982: 75%

Pulp capacity: 2,000,000 tons
Operating rate 1982: 71%

(000 metric tons)

	Production		Imports		Exports	
	1981	**1982**	**1981**	**1982**	**1981**	**1982**
Paper	1,233	1,170	80	107	924	898
Board	140	134	110	97	91	84
Total	**1,373**	**1,304**	**190**	**204**	**1,015**	**982**
Chemical woodpulp	697	642	280	219	255	210
Other pulps	911	880	3	3	191	162
Total	**1,608**	**1,522**	**283**	**222**	**446**	**372**

Portugal

Population: 10,088,200. Per capita consumption of paper and board: 51 kg/112 lb. Number of paper and board mills: 95. Number of pulp mills: 8 (sulfate: 5; sulfite: 2; soda: 1).

Paper/board capacity: 700,000 tons
Operating rate 1982: 83%

Pulp capacity: 960,000 tons
Operating rate 1982: n.a.

(000 metric tons)

	Production		Imports		Exports	
	1981	**1982**	**1981**	**1982**	**1981**	**1982**
Paper	390	370	46	47	21	21
Board	181	216	30	34	122	137
Total	**571**	**588**	**76**	**81**	**143**	**158**
Chemical woodpulp	853	909	23	13	455	521
Other pulps	42	43	1	7	0	0
Total	**895**	**952**	**24**	**20**	**453**	**521**

Romania

Population: 22,000,000. Per capita consumption of paper and board: 32e kg/72 lb. Paper and board mills: 20. Pulp mills: 11 (sulfate: 6; sulfite: 3; semichemical: 1; mechanical: 1; nonwood: 4)

Paper/board capacity: 870,000 tons

Pulp capacity: 850,000 tons

(000 metric tons)

	Production		Imports		Exports	
	1981	**1982**	**1981**	**1982**	**1981**	**1982**
Paper	305	305	na	na	na	na
Board	500	500	na	na	na	na
Total	**805**	**805**	**46**	**46**	**167**	**167**
Chemical woodpulp	645	645	na	na	na	na
Other pulps	170	170	na	na	na	na
Total	**815**	**815**	**134**	**134**	**10**	**10**

South Africa

Population: 24,000,000. Per capita consumption of paper and board: 55 kg/121 lb. Number of paper and board mills: 16. Number of pulp mills: 10 (sulfate 2; sulfite 1; soda 1; semichemical 2; mechanical 2; nonwood 2)

Paper/board capacity: 1,320,000 tons

Pulp capacity: 1,190,000 tons

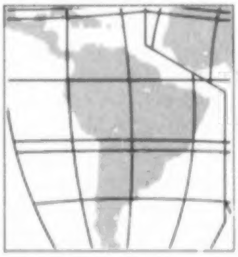
(000 metric tons)

	Production		Imports		Exports	
	1981	**1982**	**1981**	**1982**	**1981**	**1982**
Paper	721	748	174	158	135	171
Board	565	553	80	81	39	36
Total	**1,286**	**1,301**	**254**	**239**	**174**	**207**
Chemical woodpulp	433	460	207	216	23	30
Other pulps	639	704	0	0	363	363
Total	**1,122**	**1,165**	**207**	**216**	**386**	**393**

startup of Australian Newsprint Mills' new Albury newsprint mill. However, printing/writing and packaging grades suffered from cheaper imported products.

Key event in 1982 in **New Zealand** was the purchase of Crown Zellerbach Canada by Fletcher Challenge. Among other developments were the startup of the Te Papapa 20,000-tpy corrugating medium mill by New Zealand Forest Products, and an advance in the proposal for a new 125,000-tpy newsprint line to be added to Winstone Samsung's Karioi pulp mill.

In Australia, developments included a takeover bid by North Broken Hill Holdings for Associated Pulp & Paper Mills; a decision by APPM and its Japanese partners to shelve plans for a 230,000-tpy kraft pulp mill in Tasmania; and a major salvage operation in about 20,000 acres of pine plantations following major fires in South Australia and Victoria in early 1983.



LATIN AMERICA

THE DEPTH AND LENGTH of the recession fell particularly hard on Latin American nations in 1982 because of the heavy foreign debts of several major countries—**Brazil**, **Mexico**, and **Chile**, in particular. The strength of the U.S. dollar and—for Mexico and Venezuela—the drop in international oil prices and consumption led to critical debt-rescheduling measures during the past 12 months.

Severe austerity measures were imposed by several governments, partly in response to these debt-rescheduling agreements and the conditions requested by international lending organizations. This, in turn, tended to depress domestic demand for consumer goods, which had a negative effect on paper and board consumption.

Despite this uncomfortable economic situation, total Latin American paper and board production in 1982 rose marginally (0.9%) to 7.6 million metric tons. **Argentina** accounted for much of the increase with an 11.6% jump in output to 732,000 tons, with **Venezuela** not far behind (10.6% increase to 540,000 tons). Modest improvements were also recorded in Mexico (up 1.9% to 1.99 million tons). Small declines were reported in Brazil and **Peru**, and an almost 20% falloff in **Chile**'s output.

But **Brazil** had a bright spot in the success of its pulp and export markets. During most of the recession, the major pulp mills were able to run at virtually full capacity, and in 1982 Brazil's market pulp exports rose almost 7% to 810,000 tons.

Capital investments. Several key capital spending projects were completed in late 1982 or early this year: the Alto Parana 172,000-tpy bleached softwood kraft market pulp mill and Papel del Tucuman's 107,000-tpy bagasse newsprint mill in **Argentina**; the addition of a bleach line to Riocell's existing eucalyptus kraft pulp mill in **Brazil**; **Cuba**'s 70,000-tpy Jatibonico integrated bagasse pulp and paper mill; and Kimberly-Clark de **Mexico**'s new 45,000-tpy tissue mill at San Juan del Rio.

Among major projects nearing completion are the Papel de Imprensa 116,000-tpy newsprint mill and Champion Papel e Celulose's new 95,000-tpy free-sheet paper machine in Brazil; and the Celulosa de **Guatemala** (Cel-

Spain

Population: 37,980,000. Per capita consumption of paper and board: 74 kg/163 lb. Number of paper and board mills: 203. Number of pulp mills: 33 (sulfate: 13; sulfite: 1; semichemical: 1; mechanical: 10; nonwood: 8).

Paper/board capacity: 3,155,000 tons
Operating rate 1982: 85%

Pulp capacity: 1,670,000 tons
Operating rate 1982: 90%

(000 metric tons)

	Production		**Imports**		**Exports**	
	1981	**1982**	**1981**	**1982**	**1981**	**1982**
Paper	1,421	1,430	261	342	194	197
Board	1,167	1,255	90	119	114	140
Total	**2,588**	**2,685**	**351**	**461**	**308**	**337**
Chemical woodpulp	1,021	1,040	237	259	174	151
Other pulps	333	310	4	1	9	18
Total	**1,354**	**1,350**	**241**	**260**	**183**	**169**

Taiwan

Population: 18,472,000. Per capita consumption of paper and board: 81 kg/179 lb. Number of paper and board mills: 160. Number of market pulp mills: 3 (sulfate: 1; nonwood: 2).

Paper/board capacity: 1,960,000 tons
Operating rate 1982: 79%

Pulp capacity: 400,000 tons
Operating rate 1982: 73%

(000 metric tons)

	Production		**Imports**		**Exports**	
	1981	**1982**	**1981**	**1982**	**1981**	**1982**
Paper	532	514	55	85	31	41
Board	966	1,042	21	13	129	127
Total	**1,498**	**1,556**	**76**	**98**	**171**	**168**
Chemical woodpulp	257	207	80	128	87	59
Other pulps	93	86	4	4	12	13
Total	**350**	**293**	**84**	**132**	**99**	**72**

Sweden

Population: 8,300,000. Per capita consumption of paper and board: 202 kg/445 lb. Number of paper and board mills: 57. Number of pulp mills: 59 (sulfate: 26; sulfite: 10; semichemical: 2; mechanical: 21).

Paper/board capacity: 6,860,000 tons
Operating rate 1982: 86%

Pulp capacity: 9,625,000 tons
Operating rate 1982: 80%

(000 metric tons)

	Production		**Imports**		**Exports**	
	1981	**1982**	**1981**	**1982**	**1981**	**1982**
Paper	3,936	3,567	124	132	2,918	2,544
Board	2,200	2,361	55	52	1,704	1,186
Total	**6,136**	**5,928**	**179**	**184**	**4,622**	**4,430**
Chemical woodpulp	6,531	5,867	68	74	2,436	2,107
Other pulps	1,998	1,839	10	18	380	368
Total	**8,529**	**7,706**	**78**	**92**	**2,816**	**2,475**

United Kingdom

Population: 55,950,000. Per capita consumption of paper and board: 119 kg/262 lb. Number of paper and board mills: 103. Number of pulp mills: 3 (semichemical: 2; mechanical: 1).

Paper/board capacity: 3,844,000 tons
Operating rate 1982: 83%

Pulp capacity: 192,000 tons
Operating rate 1982: 73%

(000 metric tons)

	Production		**Imports**		**Exports**	
	1981	**1982**	**1981**	**1982**	**1981**	**1982**
Paper	1,847	1,674	n.a.	106	n.a.	185
Board	1,532	1,450	n.a.		n.a.	
Total	**3,379**	**3,124**	**n.a.**	**3,955**	**n.a.**	**399**
Chemical woodpulp	50	80	1,351	1,219	n.a.	
Other pulps	90	61	205	131	n.a.	2
Total	**140**	**141**	**1,556**	**1,350**	**n.a.**	**2**

gusa) 100,000-tpy bleached softwood kraft market pulp mill.

It is hoped that the generally more favorable worldwide economic climate will bring recovery this year and next, with stable oil prices and a decline in inflationary pressures.

AFRICA

AFRICAN PAPER AND BOARD production in 1982 increased (by a mere 0.3%) from 1981 to a total of 1.85 million metric tons. Pulp output did slightly better, with a 3% increase to 1.7 million tons. The almost static production figures, plus a decrease in the number of proposed new expansion projects, were largely blamed on worldwide economic recession. Of the 19 African nations which have papermaking facilities, only four recorded a production increase in 1982 over 1981. Six of the 13 pulp-producing countries raised their annual output from the previous year.

Africa's pulp and paper output is dominated by **South Africa**, which produces twice as much as the rest of Africa put together. The fact that South Africa's 1982 paper and board output increased by only 1%, to 1.3 million tons, heavily affected the continent's total figures. South Africa's lead over other African nations will be further increased when several massive expansion projects are completed in the next two years.

These will make South Africa a major competitor in the international newsprint, linerboard and pulp markets. It is already exporting substantial newsprint tonnage. The rapid rise in newsprint production and exports in the last three years provides an indication of what is to come: in 1981, newsprint output leaped 35% and exports 53% from 1980; in 1982, output was up another 20% and exports increased by 30%. South Africa can also be expected to move up from its No. 14 position on the top world pulp producers table when Sappi's Ngodwana expansion and Mondi's 500,000-tpy Richards Bay kraft pulp mill are completed by end-1984. Mondi alone expects its new mill to generate annual export sales worth $115 to $140 million.

But it is not all good news. South African companies suffered like many others from the weak export markets throughout 1982. Not only export sales were affected; there were also reports of imported paper being sold at "dumping prices," undercutting domestic product.

Project possibilities. In two other countries a series of new mills and machine rebuilds is being carried out. The three **Nigerian** projects have been plagued by lack of funding from the government, but now two of them—one of which is a 100,000-tpy newsprint mill—are nearly complete. However, it is still impossible to set reliable startup dates, again because of shortages of funds.

Two of the main modernization programs for the **Egyptian** industry—by Rakta and National Paper—should be completed by mid-1984. A new bagasse-based newsprint mill and a small tissue mill are other projects moving out of the planning stages and into construction.

Other African projects which seem likely to be completed include Panafrican Paper's integrated mill at **Kenya**, which will add 15,000-tpy of printing/writing capacity and is due to start in early 1984. In **Tanzania**, Southern Paper Mill's project for an integrated 60,000-tpy mill producing printing/writing and kraft paper and board is also scheduled to start up in early 1984.

Another project which is a long way from startup but which still could go ahead is the 250,000-tpy bleached kraft pulp mill at Pointe Noire in **People's Rep. of Congo**. The project has attracted attention because of the claimed dramatic yield rate of the eucalyptus plantations being grown specifically to supply the mill. In 1982, the yield was put at a staggering 40 m³/hectare. An international syndicate, SECC, which includes Billerud of Sweden, is reported to be investigating project feasibility. Despite advice against it, the Congolese government seems determined to go ahead with the mill project. ■

United States

Population: 232,000,000. Per capita consumption of paper and board: 250 kg/551 lb. Number of paper and board mills: 584. Number of pulp mills: 193 (sulfate: 122; sulfite: 21; semichemical: 37; mechanical: 47).

Paper/board capacity: 63,683,000 tons
Operating rate 1982: 88%

Pulpcapacity: 50,966,000tons
Operating rate 1982: 32%

(000 metric tons)

	Production		**Imports**		**Exports**	
	1981	**1982**	**1981**	**1982**	**1981**	**1982**
Paper	28,161	27,574	7,332	7,032	936	781
Board	28,333	26,558	120	106	2,683	2,524
Total	**56,494**	**54,132**	**7,442**	**7,138**	**3,619**	**3,305**
Chemical woodpulp	42,385	40,161	3,564	3,186	3,330	3,075
Other pulps	4,826	4,625	144	131	7	5
Total	**47,211**	**44,786**	**3,708**	**3,317**	**3,337**	**3,080**

U.S.S.R.

Population: 270,000,000. Per capita consumption of paper and board: 33e kg/73 lb. Number of paper and board mills: 84. Number of pulp mills: 57.

Paper/board capacity: 10,200,000e tons **Pulp capacity:** 10,390,000e tons

(000 metric tons)

	Production		**Imports**		**Exports**	
	1981	**1982**	**1981**	**1982**	**1981**	**1982**
Paper	5,401	5,522	730	690	670	730
Board	3,555	3,555	270	270	380	380
Total	**8,956**	**9,077**	**1,000**	**960**	**1,050**	**1,110**
Chemical woodpulp	7,160	7,260	271	271	955	955
Other pulps	1,900	1,900	0	0	0	0
Total	**9,060**	**9,160**	**271**	**271**	**955**	**955**

Further data on world's paper industry

Detailed data on world production, consumption, and pulp and paper industry economics is available in the 1983 Review Number published by our associate magazine, *Pulp & Paper International* (publication date July 25, 1983). Copies of this issue, which include individual reports for all producing countries, are $20 each.

To order, send payment (US$) to: *PPI*, Circulation Dept.,
500 Howard St., San Francisco, Calif. 94105

Chlorate demand to increase slightly in 1983

By BARRY SHOCKETT

The 1982 recession, which reduced demand for most chemicals and increased imports from Canada, resulted in a 30,000-ton drop in domestic sodium chlorate production, even though total demand was off only 5,000 tons.

Canadian producers are in slightly better shape due to a stronger export market, and production should increase 6% to 7%.

U.S. statistics, sodium chlorate (000 short tons)

	1980	1981	1982	1983e
Nameplate capacity	388	388	400	405
Production	278.4	280.5	250	260
Shipments	266.1	270	255	260
Imports	56.7	75.5	86	94.5
Exports	1.3	0.6	0.5	0.5
Apparent consumption	321.5	345	340.5	354.5
Pulp bleaching	263.5	283	279	299
Miscellaneous*	58	62	61.5	64

*Includes other chlorates, uranium, agriculture, and others.
Source: Bureau of Census, U.S. Dept. of Commerce.

Canadian statistics, sodium chlorate (000 short tons)

	1980	1981	1982	1983e
Nameplate capacity	314	338	400	425
Production	269.5	281	291	310
Shipments	274	281	278	310
Imports	1.2	1.4	2.2	2.2
Exports	56.2	75.5	86	94.5
Domestic demand	219	207	194	217.5
Pulp bleaching	209.5	197	183	205
Other*	9.5	10	11	12.5

*Includes uranium, agchems, and others.

SODIUM CHLORATE

UNITED STATES

Uses: Pulp mills use most of the sodium chlorate for onsite generation of chlorine dioxide. Other uses are: chemical intermediate, uranium production, and agriculture.

Demand: Chlorine dioxide generation consumes about 82% of total $NaClO_3$demand. In 1982, pulp mills consumed an estimated 279,000 tons of $NaClO_3$, out of a total of 340,000 tons. This should increase to about 290,000 tons in 1983. In 1982, imports rose 11,000 tons over 1981, to 86,000 tons, and should increase 8,000 tons in 1983.

Sources: The major chlorate producers include Erco Industries, Georgia-Pacific, Kerr-McGee, Occidental Chemical, Olin, and Pennwalt. Smaller facilities are operated by Brunswick Chemical, Huron Chemicals, and Pacific Engineering. In addition, imports from Canada continue to play an increasing role in the U.S. market place.

Availability: With operating rates remaining low and imports on the rise, supplies will remain adequate. 1982, market; 1981, market; 1980, market.

Pricing: An attempt was made last summer by most producers to remove the $45/ton discount off the $420/ton list, but the soft economy in the second half of 1982 caused the selling price to revert to $375/ton. The discounted price remained in effect in the first half of 1983, although one producer tried to boost the off-list price by $30/ton. List prices are still $420/ton, and are not expected to change in 1983. As the economy improves, the discount should decrease. 1982, $420/ton; 1981, $375/ton; 1980, $345-$375/ton.

Forecast: Sodium chlorate pulp mill usage is not expected to rise more than 4% this year. Imports from Canada are likely to continue to increase.

CANADA

Uses: Most $NaClO_3$ produced, either captively or for merchant sales, is employed by kraft pulp mills for onsite generation of chlorine dioxide used in pulp bleaching. Other uses: uranium processing and agchems.

Demand: Pulp mills used about 183,000 tons in 1982 (about 95% of the total) a drop of 7% for 1981 due to weak pulp production. In 1983, demand should increase to 205,000 tons.

Sources: Major merchant producers are: Canadian Occidental, Erco Industries, QueNord, and PPG Industries' Stanchem Div. New producer BCM Technologies postponed its onstream date to this summer, and all its output will be exported to the U.S. market. Three more small plants closed in 1981, and the remaining captive producers are BC Chemicals, St. Anne Chemical, and Saskatoon Chemicals.

Availability: Canadian capacity increased 62,000 tons in 1982 and will go up 25,000 tons this year and 26,000 tons in 1984. This will ensure an adequate supply for domestic mills. 1982, market; 1981, market; 1980, market.

Pricing: List prices increased at the beginning of 1983 to $435/ton from the $410/ton price at the end of 1982. However, due to depressed market pulp mill demand, list prices were discounted about $25/ton. The discount will probably be removed when markets improve. History: 1982, $410/ton; 1981, $365/ton; 1980, $310-$330/ton.

Forecast: As the economy revives, companies will implement postponed ClO_2 generation projects, and pulp mill chlorate demand will increase 8.0%/year.

Mr. Shockett is consulting editor-chemical markets for Pulp & Paper.

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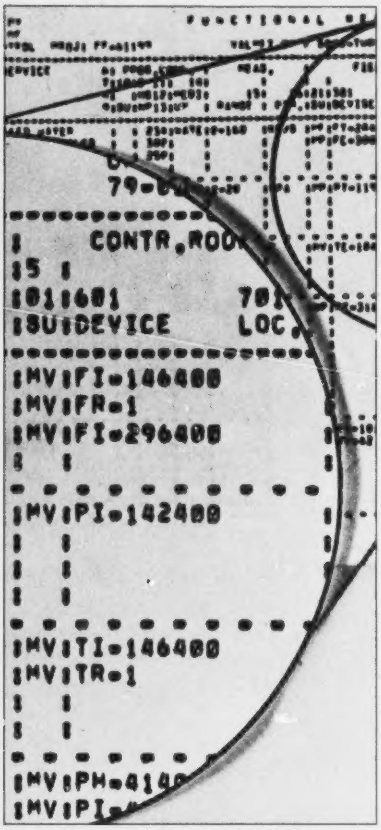

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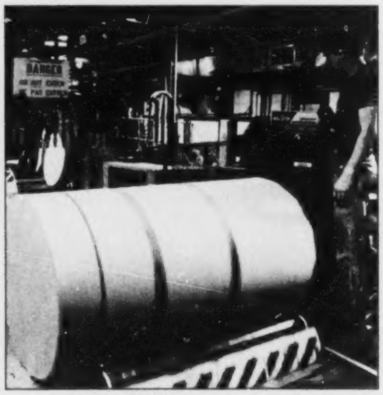

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COVER: *Computer-aided drafting station is one of the tools utilized by engineers at Simons-Eastern Co., Atlanta, Ga. (Photo courtesy of Martin Public Relations Associates.)*

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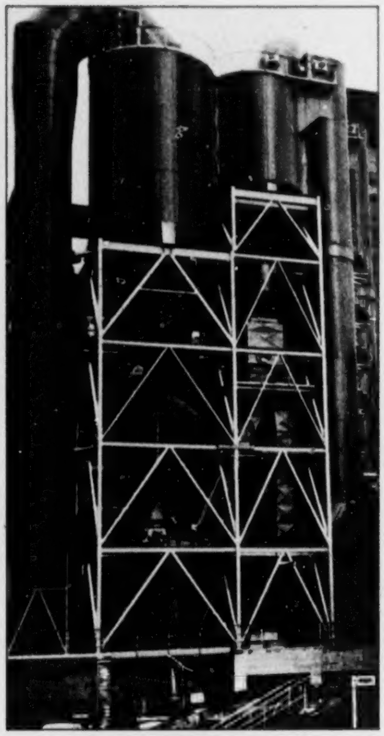

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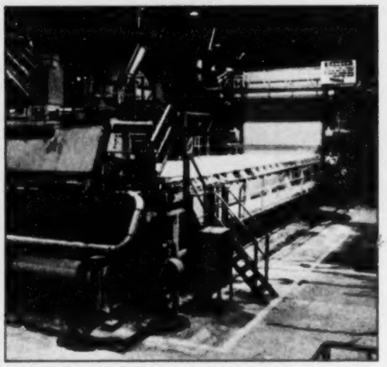

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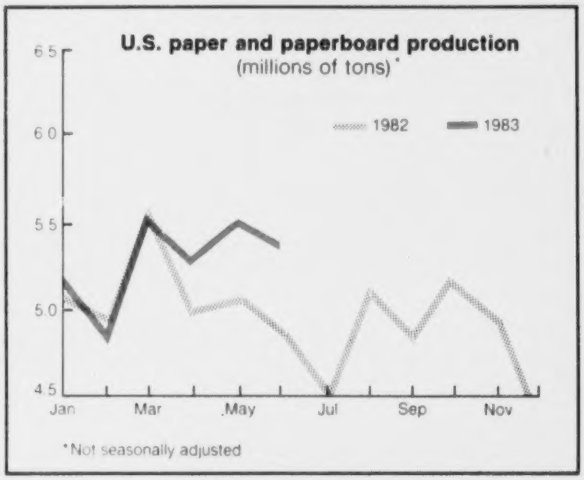
MONTH IN STATISTICS

U.S. paper and paperboard production in June totaled 5.383 million tons, up 10.4% from June 1982, according to the American Paper Institute. Production for the second quarter established a new record of 16.21 million tons, just topping the old record of 16.16 million tons set in the 1981 second quarter. Total production in the first half of 1983 was at a seasonally adjusted annual rate of 62.6 million tpy, 5.6% ahead of last year and 0.5% below the record 1981 first half.

Among major grades, printing/writing paper grades continued to strengthen, with uncoated free sheet up 9.8% over last June and coated paper up 9.2%. Paperboard production for the second half of 1983 was up 5.8% over year-earlier levels, with the largest gains continuing in containerboard. Containerboard for domestic use was up 6.2% from a year ago, while corrugated box shipments rose 7.6% compared to last year, according to the Fibre Box Assn.

Canadian newsprint shipments totaled 795,000 metric tons in June, up over 30% from a year ago, according to the Canadian Pulp & Paper Assn. Newsprint mill operating rates stood at 90% in June compared with 85% last year.


U.S. paper and paperboard production
(millions of tons)*

*Not seasonally adjusted

		Latest month (000 short tons)	% change from year ago	Annualized year-to-date (000 short tons)	% change from year ago
PAPER & PAPERBOARD PRODUCTION [1]					
Newsprint	June	410	−3.1	5,119	−2.3
Uncoated groundwood (s)	June	126	10.5	1,458	2.8
Coated paper (s)	June	463	11.7	5,414	9.2
Uncoated free sheet (s)	June	723	18.7	8,636	9.8
Unbleached kraft packaging and industrial (s)	June	310	6.2	3,717	0.6
Tissue	June	404	13.8	4,746	7.2
Total paper	**June**	**2,710**	**10.7**	**32,300**	**5.6**
Kraft linerboard, unbleached	June	1,236	9.7	14,793	7.5
Semichemical medium	June	396	5.3	4,639	3.3
Bleached paperboard	June	326	5.2	3,923	3.0
Recycled paperboard	June	615	13.9	7,114	6.8
Total paperboard	**June**	**2,673**	**10.0**	**31,533**	**5.8**
Total paper and paperboard*	**June**	**5,383**	**10.4**	**63,833**	**5.7**
PULP, WASTEPAPER & FIBER [2]					
Total woodpulp production	May	4,519	5.9	52,122	2.0
Market pulp production	May	583	21.5	6,410	5.8
Wastepaper consumption at paper/board mills	May	1,221	2.3	14,206	3.9
Pulpwood consumption (cords)	May	6,693	6.2	83,954	6.3
CONVERTED PRODUCTS STATISTICS [3]					
Corrugated box shipments (billion ft²)	June	22.044	9.8	123.873†	7.6
Containerboard inventories at box plants	June 1	2,463	−7.5		
INTERNATIONAL TRADE [2]					
U.S. paper imports (including products)	May	746	—	8,339	3.8
Imports of Canadian newsprint	May	597	−3.4	6,503†	−4.1
U.S. paper exports (including products)	May	415	9.2	4,525	8.9
Exports of unbleached kraft linerboard	June	190	13.8	14,793	7.5
Exports of woodpulp	May	378	16.0	3,818	7.2
CANADIAN STATISTICS [4] (reported in metric tons)					
Total newsprint shipments	June	795	30.1	4,075†	−1.6
Operating rates	June	88%	79%	83%	83%
Inventories held by U.S. consumers	June 30	1,250	−20.3		
Woodpulp shipments (export only)	June	1,674	11.7	9,129†	−1.3
Operating rates	June	90%	85%	81%	85%

1 American Paper Institute. 2 API, Bureau of Census, American Pulpwood Assn. 3 Fiber Box Assn., Paperboard Packaging Council. 4 Canadian Pulp & Paper Assn.
*Includes construction and wet machine grades. †Not annualized. ‡Not directly comparable to year ago because of coding change. (s) = shipments.

SALES & EARNINGS

Second-quarter industry earnings rebound

With increased demand due to the continuing economic recovery partially offset by continued price weakness in some sectors, U.S. paper industry earnings gained a modest 5.9% in the second quarter of 1983 over a year earlier, according to a *P&P* survey of 23 companies. But forest products companies posted a dramatic 72.6% jump in second-quarter earnings on the strength of sharp increases in housing starts and price increases for lumber and other building products, according to the financial reports of six major companies.

Most chief executives were cautiously optimistic about prospects for the second half, seeing evidence for continued moderate recovery in higher volumes and large gains in earnings over the first quarter. "The only missing ingredient is a return to previous pricing levels," noted William R. Haselton, chairman and CEO of St. Regis Corp.

Transition to recovery. International Paper Co. reported second-quarter earnings of $49.8 million, up 20.9% from $41.2 million a year earlier. St. Regis Corp. reported net second-quarter income of $10.0 million, down 51.8% from 1982. Crown Zellerbach's second-quarter net income of $20.0 million was down 5.7% from last year, but CZ said "substantial nonoperating items" were included in 1982.

Mead Corp. reported a profit of $9.2 million for the second quarter compared to a loss of $1 million in the 1982 quarter. Pointing to depressed prices, Union Camp Corp. reported net income of $31.2 million for the quarter, down 7.6% from 1982.

Among tissue producers, Scott Paper Co. posted a second-quarter profit of $33 million, a 13% gain over 1982. Fort Howard Paper Co. announced record second-quarter sales and earnings, with net income of $25.1 million, up 12.3% from last year. Kimberly-Clark's net of $47 million was down 20.2% from 1982.

Wood products take off. With housing starts at the 1.7-million/year mark for most of the second quarter, a number of forest products companies reported large increases in earnings. Weyerhaeuser Co. led the way with a 126% surge in second-quarter profits, to $59.1 million. Champion International Corp. reported net income of $25.6 million, up 121.8% over last year. Georgia-Pacific Corp. showed a 21.1% decrease in second-quarter earnings to $56 million, but the $71-million profit posted last year included substantial nonoperating income. Louisiana-Pacific Corp. posted earnings of $12.1 million compared to a $4.3-million loss last year.

Canadian mills back in black. Canadian pulp and paper companies bounced back from a loss in the first quarter to post a profit of C$43,465 in the second quarter of 1983, a dramatic jump of 354% over the 1982 second quarter, according to reports from ten producers. The improved earnings came on sales of $2.7 billion, up 8.5% over a year earlier.

While the earnings gain signaled a turnaround, many companies continued to suffer from the low demand and weak prices for newsprint and market pulp that have plagued the industry during the recession. Most of the improvement resulted from rebounding demand and better prices for fine papers, linerboard, and lumber.

U.S. PAPER/FOREST PRODUCTS RESULTS

	Second quarter (000 dollars)			
Paper companies	**Sales**	**Change 1983/82**	**Earnings**[1]	**Change 1983/82**
Chesapeake	$63,219	11.6%	$2,389	35.5%
Consolidated	142,495	7.6	12,005	10.4
Crown Zellerbach	652,300	−14.1	20,000	−5.7[2]
Federal Paper	128,931	12.4	1,575	−68.0
Fort Howard	146,585	7.5	25,130	12.3
Glatfelter	62,863	0.7	4,992	4.6
GN Nekoosa	389,600	8.8	21,700	13.0
Hammermill	359,613	8.1	5,951	−43.5
Int'l. Paper	1,073,000	4.1	49,800[3]	20.9
James River (4/24)[4]	479,808	131.7	19,595	192.2
Kimberly-Clark	826,000	13.3	47,000	−20.2[5]
Longview (3/30)[4]	84,647	−11.9	921	−83.0
Mead	627,300	13.0	9,200[6]	n.m.[7]
Mosinee	24,068	19.9	1,403	41.1
Pentair	73,846	2.6	2,810	−13.8
St. Regis	699,374	6.9	9,963	−51.8
Scott	613,767	4.4	33,033	13.0
Sonoco	168,965[6]	23.4	6,394	−17.4[6]
SW Forest	173,002	23.1	187	n.m.[7]
Union Camp	461,107	18.4	31,150	−7.6
Wausau (5/31)[4]	45,611	−1.4	825	63.4
Westvaco	359,102	−4.7	11,105	−34.7
Willamette	273,919	17.0	4,954	n.m.[7]
Total	**7,929,122**	**9.7**	**332,082**	**5.9**
Forest products				
Boise Cascade	869,490	17.4	16,970	n.m.[7]
Champion Int'l.	1,061,491	11.7	25,564	121.8
Georgia-Pacific	1,699,000	20.2	56,000	-21.1[8]
Louis.-Pacific	295,540	11.1	12,140	n.m.[7]
Potlatch	227,219	10.5	9,908	21.9
Weyerhaeuser	1,281,138	17.4	59,110	126.1
Total	**5,433,878**	**16.4**	**179,692**	**72.6**
U.S. total	**13,363,000**	**12.3**	**511,774**	**22.5**

CANADIAN PAPER INDUSTRY RESULTS

Abitibi	C$447,812	7.6%	C$9,998	−55.0%[6]
B.C. Forest	239,400	10.5	(4,500)	n.m.
Con-Bathurst	366,000	−1.6	9,100	−48.0
CZ Canada	199,700	16.5	(3,900)	n.m.
Domtar	450,200	6.0[6]	8,600	n.m.[7]
Fraser	108,600	9.3	2,130	n.m.[7]
Great Lakes	129,723	18.8	(108)	n.m.[7]
Mac. Bloedel	533,700	14.3	11,700	n.m.[7]
Rolland	56,200	37.7	1,537	n.m.[7]
Scott	46,800	−50.0	2,108	−49.8
Weldwood	56,000	43.1	6,800	n.m.[7]
Total	**2,734,135**	**8.5**	**43,465**	**353.8**

1. Income after taxes, from continuing operations, excluding most significant nonrecurring items in both years.
2. 1982 quarter includes CZ Canada interest sold effective Dec. 31, 1982, and a pretax gain of $9.6 million from the sale of an interest in a Chilean paper company.
3. Includes pretax gain of $15.7 million from sale of land in Florida.
4. Period ended. James River figures are fourth quarter, Wausau third.
5. 1982 quarter included $13.9 million from a stock-for-debt swap.
6. 1982 figures restated by company.
7. Not meaningful due to loss in 1982 second quarter.
8. 1982 quarter includes $8-million gain from the sale of tax benefits and $67 million from the sale of gas/condensate royalty interest.

n.m. = not meaningful ( ) = loss.

CAPACITY

Canadian capacity foreseen rising

Canadian capacity will rise modestly between 1982 and 1985, except for printing/writing papers and thermomechanical pulps, where increases will be hefty, according to the Canadian Pulp & Paper Assn.'s annual capacity survey.

Aside from these two product areas, the survey offers evidence that capacity rises in major grades are slowing down from the overheated pace of the last few years. Market pulp capacity in 1985 will be 5% higher than in 1982, compared with a 7.1% increase between 1979 and 1982, while newsprint will rise by only 3.4%, down from a 9.6% jump over the previous three years.

Indeed, excluding market mechanical pulp—including TMP—the growth rate in market pulp would be anemic by recent standards. And most of that TMP rise is represented by conversion to TMP from unbleached sulfate at Consolidated-Bathurst Ltd.'s Bathurst, N.B., mill—although the resulting TMP is actually intended to supply Con-Bath's Ellesmere Port, U.K., mill, not the open market.

The CPPA survey predicts that annual growth in market pulp capacity, which averaged 2.9%/year between 1972 and 1982, will fall to just 1.6%/year in the 1982-85 period. In that group, capacity of mechanical market pulp—including Bathurst—will rise at 9.9%/year, down slightly from the 10.5%/year rate of 1972-82.

As in all recent surveys, British Columbia continues to dominate the capacity news. But even there, the slackening pace of capacity additions shows up: British Columbia pulp capacity will climb just 6.8% from 1982-85, compared with the 14.9% jump predicted in last year's three-year forecast. The province's paper and board capacity is expected to go up 14.5%, down from the 25.7% seen last year. And in the previous year's survey, the numbers had been 20.7% for paper and board and 26.8% for pulp.

Newsprint. While the 1983 startup of the new Iroquois Falls, Ont., machine of Abitibi-Price Inc. is shown in the new survey—plus installation of three twin-wire formers and general machine improvements—CPPA also expects six machines to be shut down permanently and two more to be upgraded to other products. A total of 340,000 tons of new capacity will be added, bringing total industry capacity to 10.3 million tpy by 1985.

Groundwood specialties. In 1982, Consolidated-Bathurst Inc. started up a new groundwood machine at Trois Rivières, Que., and two newsprint machines are being upgraded by Abitibi-Price Inc. at Beaupre, Que., to produce groundwood specialties. Net result of all increases will be a 350,000-ton increase in Canadian capacity by 1985.

Book/writing, sanitary papers. Two new machines in this area represent an unusually dramatic jump for Canada's printing/writing industry, with a net increase of 144,000 tons of capacity expected. Most of that will come from MacMillan Bloedel Ltd.'s new Island Paper Mills machine and Great Lakes Forest Products Ltd.'s new Dryden, Ont., unit. Sanitary paper capacity will rise by 12.3% to 510,000 tpy, largely on the strength of a planned expansion at Scott Paper Ltd.'s New Westminster, B.C., mill.

Paperboard. Mill modernizations will result in capacity increases at board mills, but no dramatic increases are planned. Containerboard capacity will rise 112,000 tons to 1.9 million tpy and boxboard will go up 53,000 tons to 811,000 tpy.

Total pulp. Switchover to TMP from stone groundwood and atmospheric-refiner pulp accounts for the lion's share of planned pulp capacity increases, as capacity for all grades is seen rising by 974,000 tons to 24.1 million tpy—including a 1.2-million-ton increase in TMP capacity to 3.6 million tpy. Also down will be sulfite and dissolving/special alpha, partly as a result of the shutdown of CIP Inc.'s Hawkesbury, Ont., mill. Increases at Fraser Inc.'s Atholville, N.B., mill and Tembec Inc.'s Temiscaming, Que., facility will partially offset the shutdown.

Bleached softwood kraft pulp capacity will rise by 6.1% to 6.7 million tpy, mostly from a major expansion at Northwood Pulp & Timber Ltd. in Prince George, B.C., and projects at GLFP in Dryden and E.B. Eddy Forest Products Ltd. at Espanola, Ont.

Market pulp. Except for the deceptive TMP gain, market pulp capacity will not rise in the double digits during the period of this survey. The most significant rise in tonnage terms is the 242,000-ton jump in bleached softwood kraft, the result of the Northwood, Eddy and GLFP projects.

Canadian industry annual capacity growth, 1982-85
(000 metric tons)

Market pulp	**1982**	**1983**	**1984**	**1985**
Dissolving & special alpha	305	237	243	248
Sulfite paper grades	369	360	364	374
Sulfate paper grades	6,471	6,684	6,731	6,747
Bleached softwood	5,128	5,313	5,363	5,370
Semibleached softwood	438	464	464	463
Bleached hardwood	669	687	683	693
Unbleached	236	220	221	221
Total chemical paper grades (excl. dissolv. & sp. alpha)	6,840	7,044	7,095	7,121
Increase from prev. year	30	204	51	26
	0.4%	3.0%	0.7%	0.4%
Mechanical	472	522	629	627
Total market pulp capacity	**7,617**	**7,803**	**7,967**	**7,996**
Increase from prev. year	187	186	164	29
	2.5%	2.4%	2.1%	0.4%

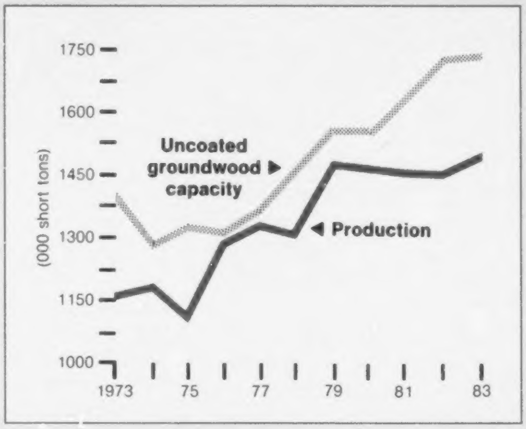
Paper & board	**1982**	**1983**	**1984**	**1985**
Newsprint	9,935	10,100	10,215	10,275
Groundwood printing	750	885	1,050	1,100
Book, writing & misc.	1,008	1,026	1,101	1,152
Kraft papers	527	542	553	551
Special papers	38	38	38	38
Sanitary papers	454	465	497	510
Containerboard	1,799	1,842	1,891	1,911
Boxboard	758	789	802	811
Total (excl. bldg. & other)	15,269	15,687	16,147	16,348
Building & other	767	754	757	758
Total paper & board capacity	**16,036**	**16,441**	**16,904**	**17,106**
Increase from previous year	447	405	463	202
	2.9%	2.5%	2.8%	1.2%

Source: Canadian Pulp & Paper Assn.

Uncoated groundwood
paper: Slow recovery with low operating rates continuing

Statistics:	**1981**	**1982**	**1983e**
Production, 000 tons	1,463	1,459	1,502
Capacity, 000 tons	1,625	1,742	1,747
Utilization rate, %	90.0	83.8	86.0
Imports, 000 tons	650	653	710
Exports, 000 tons	120	56	40
Apparent U.S. consumption			
000 tons	1,993	2,056	2,172
lb/capita	17.41	17.79	18.61
000 tons/$billion real GNP (1972)	1.32	1.38	1.42

Note: all tons are short tons e=estimated



Estimated capacities of major companies are:

	Annual capacity (000 short tons)		Capacity N. American market	
	U.S.	**Canada**	**Total**	**%**
1. Consolidated-Bathurst Ltd.	—	390	390	10.5
2. CIP Inc.	—	380	380	10.2
3. Abitibi-Price Inc.[1]	—	375	375	10.1
4. Great Northern Nekoosa	375	—	375	10.1
5. MacMillan Bloedel Ltd.	—	330	330	8.9
6. Boise Cascade Corp.	40	260	300	8.1
7. St. Regis Corp.[2]	221	—	221	6.0
8. Domtar Inc.	—	200	200	5.4
9. Madison Paper Industries	144	—	144	3.9
10. Fraser Inc.	135	—	135	3.6
11. Crown Zellerbach	130	—	130	3.5
12. Kimberly-Clark Corp.	93	28	121	3.3
13. Bowater Inc.	70	—	70	1.9
14. Pejepscot Paper[3]	56	—	56	1.5

[1] Does not include net increase of 60,000 tpy at Beaupre mill; startup in October 1983.
[2] Includes 34,000 tpy at Hennepin Paper Co., acquired at start of year.
[3] Subsidiary of Hearst Corp.

North American capacity (1983); **3.710 million tons** (U.S. 1.747; Canada 1.963)
Capacity share of top five companies: 49.9%
Capacity share of top ten companies: 76.8%

Grade structure: Uncoated groundwood papers are members of the same family as newsprint in terms of manufacturing process and physical properties, although the uncoated groundwood grades have better printing characteristics and endurance plus higher brightness—typically 64 to 72 Elrepho compared with 56 to 62 for newsprint. Uncoated groundwood constitutes, with newsprint, the bottom end of the pricing scale for printing papers. Typical end-uses include directories, catalogs, periodicals, advertising circulars and business papers, such as computer printouts. Basis weight range is 20 lb to 45 lb/3,300 ft².

Production/capacity: U.S. production of these grades peaked in 1979 and fell slightly through 1982 before turning back up with a 3.1% rise in the first five months of 1983, according to American Paper Institute figures. Capacity rose slightly as Madison Paper Industries' new 165,000-tpy machine climbed up the startup curve after coming online in late 1981, but is expected to reach only 1.749 million short tpy in 1985.

Canadian capacity is grossly distorted by Canadian Pulp & Paper Assn. figures due to underreporting among producers to avoid U.S. tariff penalties. CPPA places 1983 capacity at 976,000 short tpy and 1984 at 1.157 million short tpy, but *P&P* believes more accurate figures would be 1.94 million tpy and 2.05 million tpy.

Further complicating the question of capacity is the ability of mills to swing capacity among newsprint, uncoated groundwood and coated groundwood. For example, the normal three or four major producers of paperback book stock were joined in 1982 and 1983 by an estimated 12 or more new competitors—newsprint and coated paper mills with underutilized capacity. *P&P* capacity estimates, therefore, focus on those machines which mills would optimally like to see producing uncoated groundwood.

Outlook: During the back-to-back recessions of 1979-82, uncoated groundwood mills were squeezed between overcapacity in newsprint and the same problem in coated groundwood. Consumption did not fall drastically, however, and as coated groundwood and newsprint markets recover in 1983 and 1984, uncoated groundwood demand should once again approach the 2.2-million-ton level of 1979. (These numbers necessarily reflect only official Canadian production levels since real Canadian production and shipments to the U.S. are impossible to track.)

Pricing: Pricing for the most part stagnated at best in 1982, and in the case of roto news and supercalendered paper, transaction prices fell by 5% to 10%. List prices of some groundwood grades are ($/short ton): 25-lb roto catalog—1974, 320; 1975, 320; 1976, 345; 1977, 405; 1978, 425; 1979, 468; 1980, 495; 1981, 551; 1982, 551; 1983, 600. 30-lb standard rotonews printing paper—1978, 345; 1979, 386; 1980, 427; 1981, 490; 1982, 505; 1983, 505.

Industry staffing kept ‘lean and

Much of the industry appears in better position for recovery than two years ago due to cuts made in personnel since then

By DEBRA A. ADAMS, News Editor

■ Austerity measures undertaken during the 1981-82 economic recession to reduce personnel costs appear now to be more than an emergency reaction to plummeting earnings. The effects are expected to have a long-term impact on the way pulp and paper companies operate.

Many in the industry are likely to remain "lean and mean" for some time to come, even when business returns to normal, said Graham Dallas of British Columbia Forest Products Ltd.

"The recession has been too long and too deep and we're not going to forget too quickly," said Carol Olwert of St. Regis Corp. "I don't see the company going back to the way it did business."

In a *Pulp & Paper* survey of 32 North American companies—most of which have reduced their work force significantly and made other personnel cost reductions in 1982—only a few intend to indiscriminately restaff as sales pick up. Most plan to look closely at any openings—reviewing them to determine whether they should be filled, combined with one or more other positions, or be eliminated.

In addition to maintaining a lean staff, the majority of companies polled are keeping travel budgets, training costs, and other expenses down, either through voluntary employee cooperation, or by requiring strict adherence to budget constraints.

TRAINING ESPECIALLY HARD-HIT. Training was particularly hard hit during the recession. It is usually one of the first of the services offered to employees to be cut when budgets are slashed, said BCFP's Dallas. "Training usually gets hit first and then personnel and public relations," he said.

Yet, BCFP continued some training programs during mill shutdowns in an effort to make the best use of staff time, Dallas noted. Abitibi-Price Inc. also continued its training programs but made sure that each course was essential.

From the survey results, it appears nearly all companies reduced travel budgets as well. In only a couple of cases did travel costs actually increase.

Southwest Forest Industries Inc. reduced travel costs in certain areas but increased its managers' travel budgets. The company felt managers should keep in close contact with their staff to maintain morale and productivity levels while the work force was being reduced.

MAINTAINING MORALE IMPORTANT. Some companies made special efforts to maintain good employee relations while the austerity programs were underway. Others claim morale improved as a natural consequence of hard times in the industry.

At BCFP, morale among managers improved because of a "common goal of survival," said BCFP's Dallas. "In some cases the animosity that existed among management and union hasn't disappeared completely but it has been helped by everybody having a common goal," he said.

In addition, the opportunity for advancement was better for employees as staffing was reduced at BCFP.

"When there are less people to go around, there's more work. It means you get to do part of someone else's job, too. So there's been many cases where people have actually appreciated the expanded opportunities that having more work to do gave them," he noted.

OUTPUT HAS DROPPED. At CIP Inc., morale suffered as a result of measures instituted there. "The output per person has not increased in view of the work load people have and it has created an incredible amount of anxiety and tension which is counterproductive," said Roger Allard of CIP.

In a study done for the Conference Board of Canada, Sally R. Luce indicated that companies in which morale was low would have a problem with high employee turnover.

"Already the head-hunting firms are getting a disproportionately high number of inquiries from staff in companies that managed retrenchment poorly."

"When the economy picks up, its going to be like Exodus in the Bible. Except these peopole won't wait for the seas to part; they'll rent boats and canoes," she said.

In Canada, the government tried to prevent the loss of salaried personnel on layoff by allowing companies to give its laid-off workers some compensation on top of government unemployment benefits.

Many companies have tried to alleviate as much suffering as possible while reducing personnel. Many of-

mean' after recession's cutbacks

fered early retirement programs or instituted hiring freezes and trimmed staff through attrition. Some laid off all the most recently hired employees.

OPENINGS SCRUTINIZED CAREFULLY. Many companies did not reduce personnel by cutting departments across the board. Instead, they carefully reviewed jobs to determine which were the most expendible.

Abitibi-Price Inc. vice president of personnel, Warner Woodley, said the company's philosophy in trimming its staff was "trying to get lean, get far more effective, but not cut into the muscle or bone of the organization."

"We want to get rid of that excess poundage; get back into good fighting shape," he added.

MacMillan Bloedel Ltd. cut all departments, but some were hit more severely than others, including personnel and public relations. In-house advertising was completely eliminated.

"The whole company was reorganized and decentralized, broken into geographical regions which became

TABLE 1: **Personnel cost reductions since 1982 in North American pulp and paper industry.**

Company	Reduced work force	Cut salaries	Frozen salaries	Reduced travel, training
Abitibi-Price Inc.	15%	No	Yes	Yes
Boise Cascade Corp.	Yes	No	No	No
Bowater North America Corp.	Yes	No	21 mo	Yes
British Columbia Forest Products Ltd.	25%	No	Yes	Yes
Champion International Corp.	6%	No	1 yr	Yes
CIP Inc.	25% to 30%	No	Management only	Yes
Consolidated-Bathurst Inc.	3%	Top management—10%; middle management—5% 5/82 to 11/82	Top executives in 1983	Yes
Container Corp. of America	Yes	No	No	No
Crown Zellerbach Corp.	20%	No	No	No
Domtar Inc.	10%	No	Junior/middle management—6 mo; senior management—9 mo; senior executives—1 yr	Yes
Donohue Inc.	No	No	Officers only—1 yr	Yes
Eddy Forest Products Ltd.	No	No	No	No
Georgia-Pacific Corp.	No	No	6 mo	Yes
Great Lakes Forest Products Ltd.	8.7%	No	Since Jan. 1, 1983	Yes
Great Northern Nekoosa Corp.	No	No	3 mo	Yes
Hammermill Paper Co.	Yes	No	No	No
International Paper Co.	6.6%	No	5 mo	Yes
Irving Pulp & Paper Ltd.	No	No	No	No
ITT Rayonier Inc.	Yes	No	Yes	Yes
James River Corp.	No	No	3 to 5 mo	Yes
MacMillan Bloedel Ltd.	Yes	Management—10% to 15%, 4 mo	Management—since 1981	Yes
Manville Forest Products Ltd.	20%	No	6 mo	Yes
Mead Corp.	12%	No	21 mo	Yes
Ontario Paper Co. Ltd.	No	No	6 mo	Yes
Packaging Corp. of America	20%	Some	3 to 6 mo	Yes
Potlatch Corp.	6%	No	No	Yes
St. Regis Corp.	10%	No	Yes	Yes
Scott Paper Co.	15%	No	No	Yes
Sonoco Products Co.	60 people	No	8 mo	Yes
Southwest Forest Industries Inc.	10%	4% to 12%—16 mo	16 mo	Yes
Weyerhaeuser Co.	20%	No	2 to 2½ yr	Yes
Willamette Industries	30%	No	1/83-7/83	Yes

more directly responsible for the operations," said MB's Nancy Scott.

CUTS IN ENGINEERING. Mead Corp. cut its human resources, engineering, public relations, and financial departments the most. "We didn't just march through the company and take people out. We looked at jobs and functions, and I think we're a better company for it," said Tom Schumann, Mead corporate director of staffing and development.

"We found that there were things we could do more effectively in different ways," he said.

British Columbia Forest Products also cut some departments more than others. The personnel department was among the departments cut most severely. The corporate engineering department, which had six or eight people, was virtually eliminated. "Without any projects, we really have no use for any in-house engineering work," BCFP's Dallas.

Champion International Corp. also closely reviewed its staffing needs before laying off employees as its chairman Andrew Sigler feels cutting indiscriminately is "bad employee relations," indicated one corporate executive.

"He's been through those blood-lettings, and that's no way to run a busines," he noted.

EMPLOYEE RELATIONS EFFORTS EMPHASIZED. In an effort to maintain good employee relations, some companies launched programs to explain the austerity measures being taken and elicit support.

At Donohue Inc., meetings about the recession's effect on the company were held with small groups of workers in an attempt to get them to improve efficiency and productivity to keep the mills running. So far no workers have been laid off and no positions have been eliminated, said Donohue's Jacques Emond.

Abitibi-Price tried to get its employees involved in working toward the company's goal to reduce costs and improve efficiencies, resulting in some good suggestions. Two women workers in the word processing department saved the company $63,000 by coming up with a plan for doing some work in-house instead of contracting it out, said Woodley.

To maintain good relations with its employees on layoff, Mead provided job listings at all its operations. Weyerhaeuser gave generous severence pay and had out-placement programs and services.

TABLE 2: **Change in sales/employees (1977-82) for 11 pulp and paper companies.**

Company	% change
Scott Paper Co.	72.8
Boise Cascade Corp.	72.3
International Paper Co.	67.8
Crown Zellerbach Corp. (U.S. only)	63.0
Great Northern Nekoosa Corp.	61.1
Westvaco Corp. (10/31 yr)	55.6
Weyerhaeuser Co.	43.8
Fort Howard Paper Co.	36.0
Champion International Corp.	33.1
Union Camp Corp.	32.9
Georgia-Pacific Corp.	23.6
Average	49.6%

Source: First Manhattan Co. Research

LONG-TERM REORGANIZATIONS. Staff reductions at many companies were started as a short-term reaction to eroding profits but became, in many cases, highly organized long-term reorganizations of operations. Some of the companies, however, had started these programs years before the recession.

Weyerhaeuser Co. began a long-term reorganization program late in 1980, said Steve Pierce of Weyerhaeuser. "The economy spurted it on a bit quicker, so we've had a combination of overhead reductions and organizational redesign, and that's continuing," he noted.

Boise Cascade Corp. began to reorganize its corporate staff a few years ago, reducing the number of employees gradually over that period.

"We have been for a number of years examining the staffing levels and for some time have been combining jobs or reducing staff where it made sense and adding workers in other areas," said Sam Donaldson of Boise Cascade.

Great Northern Nekoosa Corp. also didn't reduce its work force during the recession because of a long-standing policy on staying lean.

"We looked at the situation at the start of the recession as business conditions worsened and felt that we were pretty efficiently staffed in the first place and didn't have much fat to trim," said one GNN executive.

At James River Corp., though, the philosophy is "a company can never say it's as lean as it can be," said Robert Sherry, James River senior vice president of human resources development. "We're constantly looking for areas where we might reduce costs," he noted.

CUT EXECUTIVES' PAY. Possibly in an effort to boost morale and as a example to employees, pay freezes and cuts were not limited to the rank and file at many companies. In some cases top executives took the steepest reductions.

The pay of the top five executives at MacMillan Bloedel Ltd. were reduced substantially. Their remuneration dropped to an average of C$183,000 in 1982 from C$193,000 in 1981, with chairman Calvin Knudsen's salary dropping to C$336,000 from C$360,000, according to a report from *Canadian Paper Analyst*.

Some other companies, however, raised their executives' pay during this time. At Great Lakes Forest Products Ltd., the average for the top five went to C$156,000 in 1982 from C$120,000 in 1981. At Scott Paper Ltd., the average went to C$141,000 in 1982 from C$129,000 in 1981, the report noted.

But most companies remained frugal during this time and undertook various programs to reduce payroll costs. Some tried to be as equitable as possible, with the bulk of the burden on the higher salaried people.

SALARY FREEZES IMPOSED. Weyerhaeuser froze managerial and middle-management wages for two years, but its senior managers' salaries were frozen for two-and-a-half years.

Domtar Inc. began salary freezes for all its employees on Jan. 1, 1983, but for junior- and middle-managers the freeze lasted just six months, while senior managers will not get a pay increase for nine months and senior executives will wait an entire year.

Southwest Forest Industries reduced salaries by 4% to 12% depending on the salary level, with lower-salaried people being cut last.

At Crown Zellerbach Corp. a pay-for-performance program was initiated in 1982. Remuneration is based on how employees meet objectives set for them in their respective departments, said a corporate executive.

AUSTERITY BENEFICIAL TO SOME. The austerity measures taken since early 1982 have had varying affects on companies. Some indicated operations proceeded normally, while others experienced abnormal affects.

CIP's Ailard indicated that the elimination of corporate long-term planning has had a profound effect on the company's goals. "It's all short-term, knee-jerk reaction; and, that for a business like us is quite serious," he said.

"Our bench strength needs to be rebuilt," said Mead's Schumann.

But, though some of the support functions eliminated during the past two years are missed, operations have not been significantly affected, he noted.

"We're not providing all the services we did before, but I'm not so certain that's wrong," Schumann said.

GOT RID OF DEADWOOD. Consolidated-Bathurst Inc. found that the cuts in the company's work force have been "very beneficial," according to Con-Bath's Denise Dallaire.

"It reduced an awful lot of deadwood," she noted. "The people in place have taken over a part of the work that was eliminated and are producing more in the same amount of manhours."

Potlatch Corp.'s Holly Hutchinson called the results of the cuts "a more full utilization of existing talent. The people have now picked up additional responsibilities so they have a much fuller pattern," he noted.

"We have learned that we can do the same job just as well or maybe better with fewer people in some instances," said St. Regis' Olwert.

First Manhattan Co. Research indicated in a recent report that most companies will be coming out of the recession with less overhead and greater potential for improved earnings.

The report noted that of the companies surveyed, Scott and Boise Cascade have recorded the highest increases in sales per employee as a result of staff reductions since 1977.

COMPANIES STARTING TO REHIRE. In most cases the *Pulp & Paper* survey shows salary freezes and cuts, layoffs, and other austerity measures are no longer in effect. Companies are starting to rehire and lift certain restrictions.

But, most companies indicate that the loosening of budget restraints will not mean a return to the free spending of the past. The policies started during the recession are expected to affect operations for some time to come.

"I think we're better off from the steps we've taken," said Mead's Schumann. "I don't think we'll get ourselves into the position where we have to take jobs away. We'll keep ourselves that lean."

"There is much more conservatism," said Con-Bath's Dallaire. "I don't know how long it's going to last. Probably until we start making some money."

"The guiding philosophy seems to be we survived this recession, the only way we're going to survive the next recession is to keep with this lean mentality," said BCFP's Dallas. ■

ROSIN-ALUM SIZING

(Continued from page 173)

or broke is notorious for causing excessive alum usage on machines having rosin/alum sizing. Major techniques for achieving good alum usage include the proper selection of addition points, and allowing the system to operate at a pH around 6.5, at the lowest. Reed & Smith does not attempt to control pH or to lower it artificially.

IMPORTANCE OF PRESSING, DRYING. The importance of pressing and drying conditions in redistributing rosin on the fiber surface is implicit in the hypothesis outlined previously. This can be clearly seen at Reed & Smith, particularly in terms of the influence of moisture content leaving the presses.

Work at the mill has shown that an increase in wet-press moisture from 60% or 61% (up to 63%) can lead to a loss of sizing, with the Cobb test going from about 20 g/m^2 to 40 or 50 g/m^2, unless corrective action is taken. Likewise, it has been clearly shown on several occasions that a loss of sizing can be corrected by adjustment of dryer temperatures before the size press.

The rosin and alum usages discussed in this article refer to the particular size press conditions at Reed & Smith. For most grades, the Cobb value ahead of the size press is between 50 and 100 g/m^2, and following surface sizing and further drying, a hard-sized final sheet is achieved.

However, it is possible to hard-size the sheet ahead of the size press if this is required to control the size press conditions, although this will lead to rosin usages between 0.5% and 1.0%.

SUMMARY OF ADVANTAGES. In summary, use of rosin emulsion/alum sizing in calcium carbonate filler systems offers these advantages:

- For mills that have difficulty with reactive sizes, the benefits of calcium carbonate loading may still be obtained at a relatively modest sizing cost. These benefits generally include reduced energy in refining, improved drainage and drying, and the ability to achieve higher filler contents.
- The system is relatively trouble-free and easy to control. At Reed & Smith, shift quality control testers optimize rosin usage continuously, based on Cobb values obtained at the reel.
- Transition from chalk to clay or mixed fillers, or vice versa, can be fairly easily made.

Disadvantages of the system include:

- Rosin usage slightly higher than in acid systems
- A tendency to develop foam problems, which require careful control
- A tendency for deposits to form in wet-end piping.

Rosin sizing with carbonate filler is also done in other mills in Great Britain, as well as France and South Africa (but this is not common). Some mills are said to run with carbonate filler levels around 30%. As with the so-called neutral sizes, experience has shown that higher filler contents can be obtained with carbonate than with clay before strength tests fall off. ■

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Total sulfur output, paper industry use down in 1982

By BARRY SHOCKETT

Despite last year's sharp drop in sulfur demand, sulfuric acid use was down over 2 million metric tons. Recovered sulfur output rose 3% to 4%, while Frasch production declined about one-third. Growth in recovered sulfur is expected to continue in 1983, reducing Frasch sulfur's share from 60%, to 39%. New capacity in the U.S. and Middle East has reversed the steady growth of Canadian exports, although domestic demand has also been falling.

U.S. statistics for elemental sulfur (000 metric tons)

	1979	1980	1981	1982	1983e
Capacity	13,000	14,540	15,300	16,000	16,500
Production[1]	10,827	10,785	10,607	8,614	7,750
Shipments[2]	12,015	11,837	10,117	7,942	8,650
Imports	2,494	2,523	2,522	1,845	1,600
Exports	2,044	1,782	1,392	978	1,050
Apparent consumption	12,465	12,578	11,247	8,809	9,200
Sulfuric acid	9,547	10,257	9,193	6,977	6,800
Pulp and paper	124	94	112	88	95
Other[3]	2,794	2,227	1,942	1,744	2,305

1. Recovered and Frasch sulfur only
2. Excluding sulfur content of byproduct H_2SO_4 and H_2S_1 and SO_2
3. Including agchems, paints, petroleum refining, rubber and other plastics, inorganic chemicals, etc.

Source: U.S. Bureau of Mines

Canadian statistics for elemental sulfur (000 metric tons)

	1979	1980	1981	1982	1983e
Capacity	11,023	11,132	11,242	11,290	11,535
Production	6,313	7,628	7,962	6,673	6,860
Shipments	6,105	7,820.5	8,309.5	6,792.5	6,260
Imports	1.7	1.8	4.6	2	2
Exports					
U.S.	1,265	1,517	7,666	1,132.5	1,000
Offshore	3,915.5	5,315.5	5,796	4,979	4,500
Domestic demand	924.5	888	847.5	681	762
Sulfuric acid	594	575	540	410	470
Pulping	294	262	252	220	238
Other*	51.5	51	55.5	51	54

* Including carbon disulfide, hydrogen sulfide, rubber, asphalt, soil nutrients, and others.

SULFUR

UNITED STATES

Uses: Sulfite pulp mills consume most of the sulfur used by the pulp and paper industry; some is also utilized by kraft mills. The largest end use (80%) is the production of sulfuric acid.

Demand: The pulp and paper industry used an estimated 88,000 metric tons in 1982, vs 112,000 metric tons in 1981. Total 1982 consumption was down to 8.8 million metric tons, vs 11.25 million metric tons in 1981.

Sources: Sulfur is produced in two ways: Frasch and recovered. Producers are: Frasch-Duval, Freeport Sulfur, Texas Gulf, Recovered-Shell, Amoco, Chevron Chemicals, Exxon, Standard (Calif.), and Standard (Ind.).

Availability: New output from Wyoming gas fields, together with continuing weak demand, means no foreseeable sulfur shortage. 1982, market; 1981, tight; 1980, tight; 1979, very tight.

Pricing: Prices of both sulfur types fell in the last year. In the third quarter, Frasch product, f.o.b. Tampa, was quoted at $130.30/metric ton, with a $9.84/metric ton discount for large-volume buyers. Recovered sulfur on the Gulf Coast was listed at $124.00/ton. Pricing history: 1982, $132.50-$138.75/metric ton, crude, bright, f.o.b. Gulf ports; 1981, $131.75-$138.73/metric ton; 1980, $103.31-$109.05/metric ton; 1979, $70.60/metric ton.

Forecast: As the economy recovers, sulfur use should rise 5%-6% in 1983, but prices will stay weak until fertilizer markets normalize. Pulp mill use will reach about 95,000 metric tons.

CANADA

Uses: Sulfite pulp mills use sulfur to make cooking liquor; kraft mills use it to make chlorine dioxide. Major end use is in sulfuric acid production.

Demand: Pulp mills used 220,000 metric tons in 1982, or 32.5% of the total, a 13% drop from 1981.

Sources: Major recovered sulfur producers are Amoco, Canadian Occidental Petroleum, Canterra Energy, and Chevron Standard.

Availability: Sulfur capacity rose 200,000 metric tons in 1983 and will grow 700,000 tons by 1987, ensuring supply. 1982, market; 1981, tight to market; 1980, tight; 1979, tight.

Pricing: The average sulfur selling prices, f.o.b. Alberta producing points, rose modestly in 1982. 1982's average for North American shipments was C$64.36/metric ton in December, vs $63.15 in 1981. Prices dipped in January 1983 then slipped to $59.74 in May.

Export prices f.o.b. Alberta rose to C$82.24/ton in January, and then fell 10%, to $94.01/ton in May. Alberta lists are in the $78.50-$83.50/ton range. Pricing history: 1982, crushed, slate, or molten, f.o.b. plant, $73.80-$81.18/ton; 1981, $59.58-$74.48/ton; 1980, $32.76-$59.98/ton; 1979, $24.82-$29.79/ton.

Forecast: Although growth in mechanical pulp capacity will continue to decrease sulfur use by sulfite mills over time, a slight increase is predicted for 1983. By 1987 pulp mill use will drop to 190,000 metric tons.

Mr. Shockett is consulting editor-chemical markets for Pulp & Paper.

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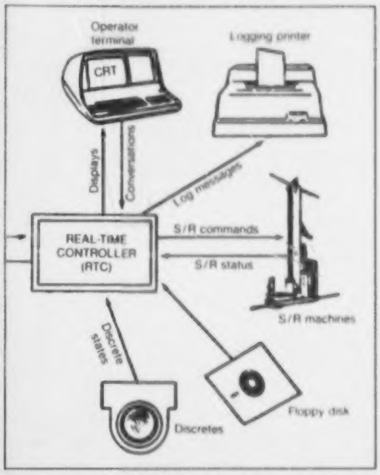

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ABP BPA

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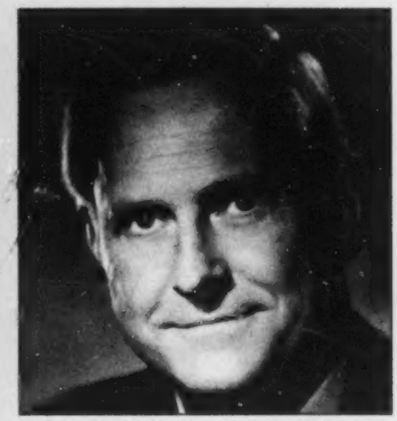

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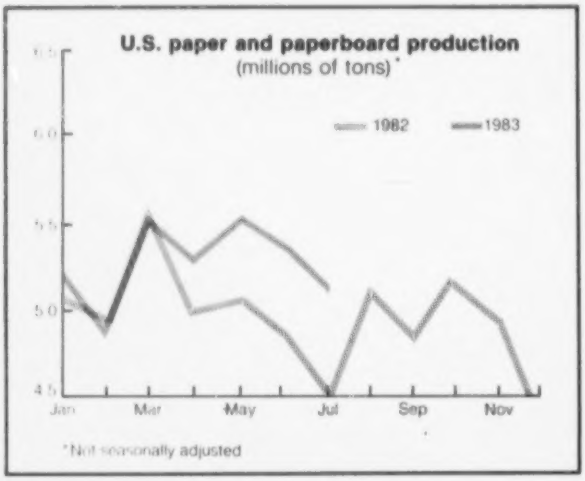
MONTH IN STATISTICS

U.S. paper and paperboard production in July totaled 5.108 million tons, up 13.1% from the depressed year-earlier level and about 3% above July 1981, according to the American Paper Institute. The June-July two-month moving average of seasonally adjusted data showed paper and paperboard production at a rate of 63.9 million tpy. Preliminary data for August indicate that the July-August average will probably show a further gain, bringing the rate above 64 million tpy.

Among major grades, printing/writing papers continued to show the strongest gains in July, fueled by heavy demand for coated papers and uncoated free sheet. Newsprint, the only grade to decline in July, was down 1.5% compared to a year earlier. Paperboard production for the first seven months of 1983 was up 6.5% over last year, with containerboard, up 9.2%, leading the way. Corrugated box shipments were up 5.3% from last year, according to the Fibre Box Assn.

Canadian newsprint shipments totaled 679,000 metric tons in July, up 10.6% from July 1982, according to the Canadian Pulp & Paper Assn. Newsprint mill operating rates stood at 80% in July compared with 71% last year.



		Latest month (000 short tons)	% change from year ago	Annualized year-to-date (000 short tons)	% change from year ago
PAPER & PAPERBOARD PRODUCTION [1]					
Newsprint	July	417	4.3	5,101	−1.5
Uncoated groundwood (s)	July	122	7.0	1,462	2.7
Coated paper (s)	July	456	16.3	5,454	10.5
Uncoated free sheet (s)	July	664	17.9	8,561	10.1
Unbleached kraft packaging and industrial (s)	July	285	–	3,677	1.3
Tissue	July	370	12.1	4,692	7.2
Total paper	**July**	**2,550**	**10.7**	**32,091**	**6.1**
Kraft linerboard, unbleached	July	1,199	19.4	14,728	9.2
Semichemical medium	July	386	12.2	4,635	4.3
Bleached paperboard	July	306	4.1	3,884	3.1
Recycled paperboard	July	561	16.6	7,050	7.8
Total paperboard	**July**	**2,553**	**15.6**	**31,380**	**7.0**
Total paper and paperboard*	**July**	**5,103**	**13.1**	**63,472**	**6.5**
PULP, WASTEPAPER & FIBER [2]					
Total woodpulp production	June	4,391	5.0	52,217	2.6
Market pulp production	June	547	11.4	6,440	6.5
Wastepaper consumption at paper/board mills	June	1,205	6.1	14,248	4.7
Pulpwood consumption (cords)	June	7,188	14.1	85,002	7.2
CONVERTED PRODUCTS STATISTICS [3]					
Corrugated box shipments (billion ft²)	July	19,582	4.8	143,455†	5.3
Containerboard inventories at box plants	July 1	2,511	−5.2		
INTERNATIONAL TRADE [2]					
U.S. paper imports (including products)	June	836	18.6	8,622	6.4
Imports of Canadian newsprint	June	650	14.0	6,719†	−1.1
U.S. paper exports (including products)	June	393	1.8	4,556	6.0
Exports of unbleached kraft linerboard	July	186	27.4	2,215	12.3
Exports of woodpulp	June	324	7.3	3,636	1.7
CANADIAN STATISTICS [4] (reported in metric tons)					
Total newsprint shipments	July	679	10.6	4,755†	—
Operating rates	July	80%	71%	83%	86%
Inventories held by U.S. consumers	July 31	1,251	−17.2		
Woodpulp shipments (export only)	July	546	17.4	3,773†	9.6
Operating rates	July	86%	68%	82%	82%

1. American Paper Institute. 2. API, Bureau of Census, American Pulpwood Assn. 3. Fiber Box Assn., Paperboard Packaging Council. 4. Canadian Pulp & Paper Assn.
*Includes construction and wet machine grades. †Not annualized. ‡Not directly comparable to year ago because of coding change. (s) = shipments.

Paper-grade chemical market pulp: Market beginning new upswing

Statistics:	**1981**	**1982**	**1983e**
United States			
Production, 000 tons[1]	4,402	4,211	4,548
Annual capacity, 000 tons	4,876	4,900	4,961
Utilization rate, %	90.3	85.9	91.7
Apparent U.S. consumption, 000 tons	4,479	3,971	4,245
Imports, 000 tons	2,390	1,998	2,137
Exports, 000 tons	2,317	2,239	2,440
Canada			
Production, 000 tons	6,081	5,283	5,680
Annual capacity, 000 tons	6,810	6,840	7,044
Utilization rate, %	89.3	77.2	80.6

[1] All tonnage is in metric tons (= 2,205 lb or 1.1023 short tons).

GRADE STRUCTURE. Paper-grade chemical market pulp is sold in the open market and does not include captive pulp used on-site or shipped to affiliated mills within North America. Pulp is divided into grades based on whether it is made from softwood or hardwood, northern or southern fiber, sulfate or sulfite pulping processes, and whether it is bleached, semibleached or unbleached. Northern bleached softwood kraft (NBSK) is the premium grade because of its long fiber and strength. Sulfate (kraft) has become the predominant pulping process, with sulfite now only 5% to 6% of production. Market pulp is sold in sheets, flash-dried bales or rolls. Some paper pulp also goes into nonpaper uses such as diapers (fluff pulp) and molded pulp products.

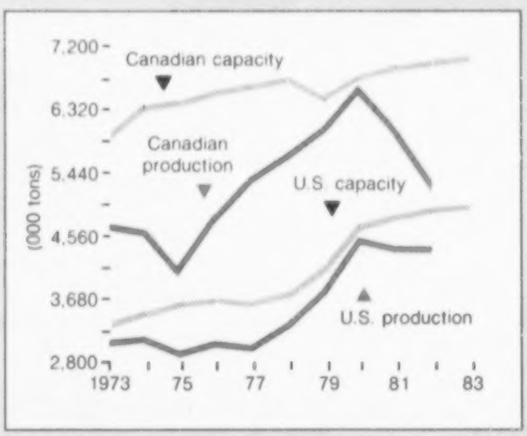
PRODUCTION/CAPACITY. In 1982, North American chemical paper-grade market pulp production totaled 9.5 million metric tons, down 9.4% from 1981. Canadian output dropped 13.1%. U.S. production declined a more moderate 4.7%.

Market pulp production has begun to pick up this year, helped by strong white paper mill operating rates in the U.S. This is causing some integrated companies to stop selling in the open market. For all of 1983, Canadian pulp production is projected to rise 7.5% to 5.7 million tons, while U.S. output is to rise 8.0% to 4.5 million tons. This assumes no major strike in British Columbia.

Norscan producer stocks have dropped from a peak of 1.93 million tons in August 1982 to 1.56 million tons at the end of July and some further decline is likely. NBSK has been in oversupply while hardwood is relatively tight.

PRICING. Pulp prices have been firming this year, after plunging roughly 25% in 1982. The benchmark price of NBSK in northern Europe plunged from $545/metric ton in the first quarter of 1982 to around $410 early this year. A new $440 price ($450 in the U.S.) announced for Apr. 1 has been heavily discounted, although increases on southern pine and hardwood have been successful.

Financially squeezed U.S. and Canadian mills hoped for a large fourth-quarter price hike, but only a moderate move now seems likely. The domestic price for NBSK will remain unchanged this quarter at $450, while southern grades move up $25/ton or more.



Estimated capacities of major companies are:

	Annual capacity (000 metric tons)	**Capacity share** ($)
1. Weyerhaeuser [1,2,3,5]	1,000	8.3
2. Georgia-Pacific [1,2,5]	750	6.2
3. Great Lakes Forest Products[1,2,3]	675	5.6
4. Parsons & Whittemore [1,2]	570	4.7
5. BC Timber [1,3]	565	4.7
6. Canadian Forest Products [1,3,4]	525	4.3
7. B.C. Forest Products [1,3,4]	480	4.0
8. MacMillan Bloedel [1,3,4]	460	3.8
9. Federal Paper Board [1,2]	331	2.8
10. Boise Cascade [1,4]	325	2.7
11. ITT Rayonier [1,5]	305	2.5
12. CIP [1,4]	290	2.4

Several companies with major holdings in the market pulp industry are not shown above to avoid double counting of capacity: Canadian Pacific, 660,000 tpy (54% of Great Lakes, 100% of CIP); Mead, 450,000 tpy (50% of Northwood Pulp, 50% of Brunswick Pulp & Paper, and 28% of BCFP); and Noranda, 431,000 tpy (49% of MacMillan Bloedel, 100% of Maclaren, and 64% of Fraser).

1. bleached softwood kraft; 2. bleached hardwood kraft; 3. semibleached softwood kraft; 4. unbleached softwood kraft; 5. bleached sulfite.

North American capacity (1983): 12.005 million tons
Capacity share of top five companies: 29.7%
Capacity share of top ten companies: 47.3%

The situation in Europe was still unclear—but not promising. European paper mills have been resisting an increase because the strong dollar has already caused their pulp costs to rise sharply. And Nordic pulp producers have little incentive to lead a price move since they are profitable due to weak currencies.

Year-end U.S. market prices for key grades in $/short ton (* indicates discounting): NBSK—1976, $372*; 1977, $310*; 1978, $340; 1979, $417; 1980, $481; 1981, $513; 1982, $408*; southern bleached softwood kraft—1976, $320*; 1977, $260*; 1978, $320; 1979, $400; 1980, $460; 1981, $450; 1982, $350*; southern bleached hardwood kraft—1976, $280*; 1977, $240*; 1978, $290; 1979, $385; 1980, $435; 1981, $385*; 1982, $320.

Wastepaper usage to keep rising,

Shortages of old corrugated and news likely as producers continue to increase portion of secondary fiber used in liner and newsprint

By DEBRA A. ADAMS, News Editor

■ Paper stock markets are expected to continue through next year the robust recovery started earlier this year due to various factors which will keep supplies of some grades tight and demand high, according to the concensus from speakers at the National Assn. of Recycling Industries' paper roundtable in Chicago in July.

Domestic and export markets have improved since earlier this year, straining supplies of several grades of secondary fiber, particularly old corrugated containers (OCC) and new double-lined kraft corrugated cuttings.

Mill operating rates have been creeping up and should start improving as the economic recovery accelerates in the fourth quarter, some speakers forecast.

CONCERN ABOUT OCC SHORTAGE. Concern about possible shortages of OCC have led to the formation of a special committee of the paper recycling division of the American Paper Institute, Howard P. Ingram of Stone Container Corp. told conferees at the NARI meeting. The committee's objective, which Ingram heads, is to investigate ways to increase the collection of OCC to avoid future shortages, he said. Recycled paperboard mills, which operated at 85.3% through July 10 compared to 80.7% at the same time last year, are increasing their consumption of secondary fiber due to improved running times and because of increased use of paper stock as a percentage of fiber furnish, said Ingram.

In 1970, only about 200,000 tons of OCC were used in the manufacture of kraft linerboard. In 1983, 1.35 million tons of OCC will be consumed, and that will increase to more than 1.70 million tons by 1986, said Ingram. He attributed increase in demand to improved cleaning technology, which is resulting in cleaner fiber. Recycled fibers comprise 20% to 30% of the furnish used in kraft linerboard presently, he noted.

Recycled 'stigma' dispelled. "For a number of years, there was a stigma about using recycled fiber in kraft linerboard," said Ingram. "The recycled fiber is now so clean the stigma has disappeared."

In addition, the cost of building a new kraft linerboard mill is presently about $350,000/daily ton while the cost per daily ton for expanding capacity of existing mills is nearly half as much. Stone spent $155,000/daily ton to expand its Florence, S.C., mill by improving cleaning equipment, said Ingram.

Another expansion of the Florence mill is expected to be completed by 1985. It also involves installing better cleaning equipment to increase recycled fiber capacity by 108,000 tons to 450,000 tpy, he noted.

Dealers look to Southeast. Ingram also noted that paper stock markets may change soon. Due to the recent deregulation of the railroads, more northeastern and midwestern paper stock producers are likely to start selling in the Southeast, he said, which is seen as "a major growth area" for secondary fiber consumption.

Wastepaper markets are also changing due to increasing consumption of old newspapers by newsprint producers within the last decade, said William Keiss of Interstate Recycling, div. Great Eastern Packing & Paper Stock Corp. In 1973, three mills using 100% old newspapers produced 312,000 tons of newsprint. In 1982, five mills using 100% old newsprint made 723,000 tons. In addition, 900,000 tons were made in 1982 by four mills using 25% or more old newspapers in their furnish, said Keiss. Demand for old newspapers should rise in proportion to the increase in consumption of newsprint. Allowing for a 2.5% average annual real growth in the economy, consumption should rise to 13.4 million tons by 1990, an increase of 19.3%, he said.

CANADIAN DEMAND ON RISE. Canadian wastepaper usage is expected to rise to 1.3 million tons in 1983, compared with 1.26 million tons last year, said David A. Berkowitz, of Hancock-Lehigh in Philadelphia.

Gypsum board, tissue and towel segments of the Canadian market are expected to show particularly strong rebounds this year, he noted. The panic buying evident earlier this year, however, has ended because

TABLE 1: **U.S. wastepaper exports to major consuming countries (short tons).**

Country	Jan.-June 1983	Jan.-June 1982	% change
Canada	165,639	125,948	+31.5%
Mexico	208,984	112,459	+85.8
Venezuela	41,994	71,901	−40.2
Italy	31,683	68,600	−53.8
China	25,998	23,928	+8.6
Japan	112,070	40,021	+180.0
South Korea	266,856	244,199	+9.3
Taiwan	246,034	232,680	+5.4
All exports	**1,218,786**	**1,064,389**	**+14.5**

Source: National Assn. of Recycling Industries from Dept. of Commerce.

say NARI roundtable speakers

mill inventories of paper stock are back to a "comfortable level," he said.

Gypsum mills are running seven days a week with backlogs that are expected to last through the end of the year, and the paperboard business has begun to show a "steady but slowly increasing trend," said Berkowitz.

Sanitary tissue market. The most positive factor of the Canadian market, however, appears to be the sanitary paper industry, which includes facial, toilet, toweling and napkin, he noted. These mills, which took no downtime in 1982, are expected to continue relying almost totally on the U.S. for their ledger grades. This segment of the industry is expected to run near capacity through 1984, said Berkowitz.

Pulp substitute prices in Canada appear to be heading for a drop in the near future if virgin pulp prices do not start to improve. Currently, pulp subs and some virgin pulp prices are at about the same level, said Berkowitz.

Increased demand for pulp substitutes is tightening the U.S. market, though, said James A. Adamski of Miami Paper Corp. He noted that fine paper markets are improving, and 1983 is expected to be a good year for printing and writing papers.

Producers of fine papers are looking closely at labor negotiations under way in British Columbia, though. Large wage settlements could put a damper on their markets by hiking virgin pulp prices, resulting in increased demand and higher prices for pulp substitutes also, he said.

MEXICAN WASTEPAPER STOCKS DOWN. Mexican mills are in dire need of fiber, but are having problems securing the financing, according to William A. Nielsen, of Nielsen & Nielsen Inc., Pomona, Calif. In addition, uncertainty over the peso entails risks in dealing with producers there. The lack of fiber has caused as many as 10 mills to shut down, he said.

Although the peso has remained fairly stable for about six months, it could easily be devalued again in the fourth quarter, noted Nielsen. The high rate of inflation in Mexico has resulted in very little consumer spending, and a production slowdown is expected in the fourth quarter, he said.

Strong dollar in Europe. The strong dollar has kept Europe out of the market. Spain has increased its wastepaper usage, but the industry there still is severely depressed. The Scans currently have an oversupply of old news of about 80,000 tons.

Italy remains the biggest European consumer and is in dire need of corrugated and the brown grades, but the industry there is also in the doldrums, said Nielsen.

Germany appears to have increased its recycling efforts and England reportedly is supplying the Netherlands, France and Spain with some paper stock. But supplies of virgin pulp are up again and demand for pulp subs is once again dropping, he noted.

Freight wars to Far East. Paper stock dealers exporting to the Far East are getting more money for their shipments currently because of cheaper freight rates, according to James Walker of Independent Paper Stock Co. Total exports of all paper stock from the U.S. are expected to reach 3.1 million tons by 1985, he said.

People's Rep. of China is expected to increase its consumption from the West Coast and East and Gulf Coast areas. Some problems need resolving, however, before the market reaches its full potential, including expanding China's facilities for ship loading and unloading, he said. Exports to South Korea and Taiwan, the two largest overseas consumers of U.S. paper stock, are expected to remain robust through the end of the year, he said. Japan, on the other hand, appears to be reducing its reliance on U.S. wastepaper supplies, said Walker. Only about 1% of its fiber needs come from the U.S. because of a "very fine" collection system within its borders. ■

TABLE 2: **Use of corrugated in U.S. mills, 1980-2000 (000 short tons).**

Grade	1980	1990	2000
Paper—all grades	244	270	310
Unbleached kraft paper	871	2,360	4,500
Semichemical paperboard	1,152	1,585	2,030
Recycled paperboard	4,200	5,190	6,210
Construction	399	420	440
Total	**6,866**	**9,825**	**13,490**

Source: Franklin Associates Ltd.

TABLE 3: **Use of old newspapers in U.S. mills, 1980-2000 (000 short tons).**

Grade	1980	1990	2000
Newsprint	852	1,500	2,200
Tissue	149	200	270
Other paper	14	30	150
Recycled paperboard	1,232	1,300	1,420
Other paperboard	12	40	45
Construction	305	350	400
Total	**2,564**	**3,420**	**4,375**

Source: Franklin Associates Ltd.

1983 pulp mill peroxide use increasing

By BARRY SHOCKETT

Although peroxide production in 1983 has been running slightly ahead of 1982, substantially higher exports (up almost 25% on an annualized basis) will result in domestic consumption dropping somewhat this year. However, the rationalized industry is predicting a return to growth in demand over the next two or three years of at least 7%/year, as most markets—including pulp bleaching—should show significant improvements over the previous years.

In Canada, where hydrogen peroxide usage by the pulp and paper industry dominates the marketplace, suppliers are expecting the strong growth in 1983.

U.S. statistics for hydrogen peroxide (000 short tons)

	1980	1981	1982	1983e
Nameplate capacity	197	193	193	179
Production	116.5	112	108	110.5
Apparent consumption	111	107.5	102	101
Pulp bleaching	12	13	13.5	15
Exports	8.5	8	9.3	11.5
Imports	3	3.5	3.2	2

Sources: Bureau of Census, U.S. Dept. of Commerce; *Pulp & Paper* estimates.

Canadian statistics for hydrogen peroxide (000 short tons)

	1980	1981	1982	1983e
Total demand	7.5	7.4	7.5	9.4
Pulp bleaching	5.2	4.9	5.1	6.8
Miscellaneous*	2.3	2.5	2.4	2.6
Imports	7.5	7	9.6	9.4

*Including textile bleaching and water treatment.

HYDROGEN PEROXIDE

UNITED STATES

Uses: Hydrogen peroxide (H_2O_2) is used by the pulp and paper industry to bleach chemical and mechanical pulps as well as to deink recycled newspaper stock. Its major use is as a chemical intermediate.

Demand: An estimated 15,000 tons of H_2O_2 will be used by pulp mills in 1983, compared with the 13,500 tons in 1982. Total consumption is expected to decrease slightly to 101,000 tons from the 102,000 tons estimated for 1982. Chemical synthesis accounts for almost 30% of peroxide demand, compared with the 15% share held by the mills. Of the remaining applications, industrial effluent treatment is showing good growth.

Sources: Following the acquisition by Interox of PPG Industries' Ohio plant late last year, the remaining three producers (in descending order of capacity) are: FMC, E.I. DuPont, and Interox America. The former PPG facility was subsequently closed early in 1983, while FMC shut down its small Washington unit, reducing industry capacity to 179,000 tons.

Availability: Despite the two closures, there is still adequate capacity to meet demand. 1982, market; 1981, market; 1980, market.

Pricing: After a two-year hiatus and following an unsuccessful attempt last summer, peroxide prices finally rose in January 1983. 70% solution in tankcars now costs 43¢/lb, f.o.b. producing point, freight equalized. Pricing history: 1982, 39.5¢/lb; 1981, 39.5¢/lb; 1980, 35.5¢-36.5¢/lb; 1979, 32.5¢/lb.

Forecast: Continuing growth in mechanical pulping plus increased H_2O_2 usage by kraft mills (in the E-2 stage) is expected to result in an annual 10% increase in pulp and paper industry demand over the next few years. The current price should remain steady up to the second quarter of 1984.

CANADA

Uses: Mechanical and chemical pulp bleaching account for most of the H_2O_2 consumed in Canada. Other end-uses include textile bleaching and water treatment.

Demand: Pulp and paper industry peroxide usage was down 4% in 1982 to an estimated 5,100 tons, compared with the 4,900 tons used in 1982. However, consumption in 1983 is expected to reach 6,800 tons, with total demand rising to 9,400 tons, compared with the 7,500 tons in 1982.

Sources: Imports continue to supply the total Canadian demand for H_2O_2. In 1982, U.S. shipments accounted for almost 90% of the total. The major importers are still C-I-L (from FMC) and DuPont Canada (from its U.S. parent), although Interox America has recently become more of a factor.

Availability: There is sufficient excess U.S. capacity to handle Canadian requirements for the foreseeable future. 1983, market; 1982, market; 1981, market; 1980, market to tight.

Pricing: Prices, unchanged for two years, rose 12% at the beginning of 1983, reflecting the price boost in the U.S. Bulk, 70% solution, tank trucks, f.o.b. Toronto, Ont./Montreal, Que., is currently $1.295/kg (58.7¢/lb). Pricing history: 1982, $1.157/kg (52.5¢/lb); 1981, $1.157/kg (52.5¢/lb); 1980, 95.8¢-$1.05/kg (43.5¢-47.6¢/lb); 1979, 90.6¢-95.8¢/kg (43.1¢-43.5¢/lb).

Forecast: Previously postponed pulp mill expansion programs reactivated as the economy strengthens should increase consumption by nearly 30%. Continuing growth in thermomechanical pulping and increasing production of higher brightness groundwood specialties could boost H_2O_2 consumption to 15,000 tons by 1987.

Mr. Shockett is consulting editor-chemical markets for Pulp & Paper.